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शासकीय कमला राजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय,  
ग्वालियर (मध्य प्रदेश)



बॉयोइंफोरमेटिक विषय के अध्ययनमंडल  
द्वारा अनुमोदित बॉयोइंफोरमेटिक विषय के  
स्नातक पाठ्यक्रम

अनुमोदन अकादमिक सत्र  
2019-2020

प्रस्तुतकर्ता

स्नातक अध्ययन केन्द्र

बॉयोइंफोरमेटिक विभाग

प्राप्तकर्ता

अकादमिक प्रकोष्ठ



वेबसाइट : [www.krgc.gwl.org](http://www.krgc.gwl.org) ईमेल : [krgc@rediffmail.com](mailto:krgc@rediffmail.com)  
दूरभाष : 0751 - 2625495, 0751 - 2438173, फैक्स : 0751 - 2625495





कार्यालय प्राचार्य, शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय, ग्वालियर  
**GOVT. KAMLA RAJA GIRLS P.G. AUTO. COLLEGE, GWALIOR (M.P.) INDIA**

(Affiliated to Jiwaji University, Gwalior under 2(f) & 12(b) NAAC – 'A' Grade Accredited Institute)  
www.krgcgwalior.org krgc@rediffmail.com Phone : 0751- 2625495, 0751-2438173

ग्वालियर, दिनांक 29 जून, 2019

~~बायोइन्फरमेटिक्स~~ विभाग

अध्ययन मंडल की बैठक का कार्यवाही विवरण

नवीन सत्र 2019-20 हेतु ~~बायोइन्फरमेटिक्स~~ विषय से सम्बंधित

अध्ययन मण्डल की बैठक आज दिनांक 29 जून, 2019 को प्रातः 11:00 बजे




~~वनस्पति शास्त्र~~ विभाग में आयोजित की गई, जिसमें निम्नानुसार उपस्थिति रही -

1. डॉ. सत्यनता पांडेय
2. डॉ. मधु लक्ष्मी शर्मा अनुपस्थित
3. डॉ. प्रीति कुलश्रेष्ठ P. Kulkarni
4. डॉ. एस. एस. सुरेशी
5. डॉ. शक्ति भारद्वाज - अनुपस्थित 29/6/19
6. डॉ. जी. जी. के. एस. प्रसाद - अनुपस्थित
7. डॉ. वेद प्रकाश 29/6/19
8. डॉ. क्रिशोर विंदे। अनुपस्थित
9. डॉ. विशाल मदन 29/6/19
10. डॉ.
11. डॉ.
12. डॉ.

अध्ययनमंडल की बैठक की कार्यवाही निम्नानुसार रही -

1. ~~बायोइ-फरमेटिक्स~~ विषय के स्नातक स्तर के प्रथम, द्वितीय एवं अंतिम वर्ष का पाठ्यक्रम अंक योजना सहित सत्र 2019-2020 हेतु अध्ययनमंडल द्वारा मान्य किया जाता है।
2. ~~बायोइ-फरमेटिक्स~~ विषय की सत्र 2019-2020 में होने वाली परीक्षाओं हेतु संलग्न परीक्षकों की सूची को अध्ययनमंडल द्वारा मान्य किया जाता है।
3. विभाग में सत्र 2019-2020 में यदि कोई शोध संगोष्ठी/कार्यशाला/अधिवेशन/अध्ययन भ्रमण आदि के आयोजन का प्रस्ताव है तो उसका विवरण एवं अनुमोदन-----
  1. one week Workshop on Application of computers in Biology & Chemistry in collaboration with Dept of Chemistry and Govt-SMS Bej college. G.M.
  2. Educational tour / training of students at MPCST, Bhopal just
  3. invited lectures - 03 -
  4. 6 months certificate course in Bioinformatics
4. यदि अन्य कोई विषय हो तो उसका विवरण एवं अनुमोदन।

हस्ताक्षर अध्ययन मंडल अध्यक्ष एवं समस्त सदस्य

  
  
P. Kumar  




2017 – 2020

**Structure of B.Sc. Programme (3 Years Degree Course)**

**Subject – Bioinformatics (as one subject)**

YEAR	PAPER(S)	Maximum Marks		
		Total	CCE	External
I	BI 101 : Introduction to Bioinformatics	100	10	40
	BI 102: Concepts in Bioinformatics		10	40
	BI 103: Practical	50	-	50
II	BI 201: Introduction to Computers and Programming	100	10	40
	BI 202 : Structural Bioinformatics		10	40
	BI 203 :Practical	50	-	50
III	BI 301 : Biostatistics	100	10	40
	BI 302 : Mathematics for Biological Sciences		10	40
	BI 303 : Practical a) Practical Work b) Project Work	50	-	50 25 25

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P. Kumar

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# B.Sc. FIRST YEAR

## THEORY PAPER I

### BI 101: INTRODUCTION TO BIOINFORMATICS

mm - 40

**Objectives:** To enable students to learn important databases and tools commonly employed to Bioinformatics.

#### UNIT I Introduction

Definition, History, Branches of Bioinformatics, Aims, Scope & research Areas, Human genome project, Role of computer in Bioinformatics, Bioinformatics in India, BIO-IT-The Flourishing future. Application of bioinformatics.

#### UNIT II Introduction to database

Introduction to genomics & proteomic data, Post genomics era, Data acquisition –functions and purposes. Biological databases-relational and object orient concepts. Information retrieval, concepts of digital libraries, information retrieval from biological databases ENTREZ-SRS, Methods for presenting large quantities of data, sequence viewer, structure viewer, RASMOL, ligand explorer.

#### UNIT III Introduction to Nucleic Data Bases

Primary & Secondary Data Base, gene banks, ENBC nucleotide, sequence data bank- DDBJ-RNA sequence data bases: 16S & 23S rRNA, Mutation data bases, HIV sequence data base, NON CODE sequence submission tools, sequin, webin, sqkura, bank etc.

#### UNIT IV Protein sequence data bases

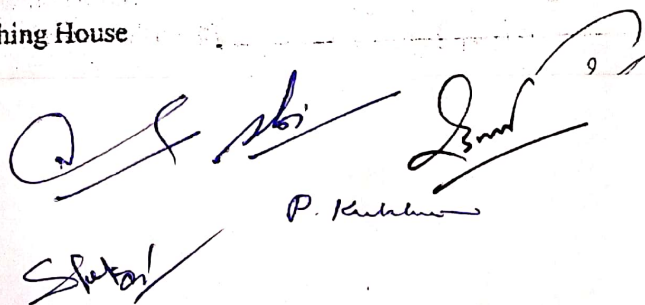
Protein sequence data bases – PIR, SWISSPROT, UNIPROT-Tr EMBL, EXPASY, NCBI, Protein, Databases – PRF, UNIPROT-MIPS-O/P-protein sequence motif database, E blocks- eblocks- PROSITE, PROTEIN DOMAIN, databases, ADDA, INTERPRO, Pfam-protein

#### UNIT V Introduction to structure data bases

PDB- PDBSum SCOP-CATH-MMDB-EMSD-SWISS-MODEL repository-ModBase-Protein MODEL portal, Eurocarb DB-DIP-BNND, STRNG

#### Books Recommended:

- 1 Orpita Basu & Simminder Kaur, Thakural "Bioinformatics Databases, Tools, Algorithm, 2007 Oxford University Press"
- 2 Higgins, D. Willie, Taylor "Bioinformatics; Sequence, Structure and Data bank, A Practical Approach, 2000, 1st Ed, Oxford University Press"
- 3 Allwood T, David Parry-Smith; Introduction to bioinformatics, 2008 Pearson Education, Singapore D.ED.
- 4 Murthy, C.S.V., 2016, Himalaya Publishing House

  
P. Kulkarni

## THEORY PAPER 2

### BI 102: CONCEPTS IN BIOINFORMATICS

MM - 40

**Objectives:** To provide students with foundation in the important concepts of Bioinformatics.

#### UNIT I

Introduction, sequence alignment, Scoring matrix, PAM-BLOSUM, Gaps and Gap penalties, Different Gap weights, Biological significance of Gaps.

#### UNIT II

Pairwise sequence alignment, DotPlot analysis, Dynamic programming, Needleman-Wunch algorithm, Smith-Waterman algorithm, Edit distance dynamic programming, Database similarity search, BLAST, FASTA.

Multiple sequence alignment, sum of pairs, Divide and Conquer, Progressive and Iterative alignment, ClustalW, TCPFFEE, Profile methods, Gribskov profile, PSI\_BLAST.

#### UNIT III

Phylogenetic relationships, Clustering and Phylogeny, Phylogenetic analysis, Concept of Phylogenetic Tree, Methods of Phylogeny analysis, Distance and character based methods, Motif detection, Protein family databases.

#### UNIT IV

Data mining, Introduction, Definition, Data mining problems, Cluster analysis, Data mining techniques, Tools and Methods. Management of Databases. DBMS, Difference between DBMS and file system.

#### UNIT V

Metabolic pathway database (KEGG pathway database), Concept of Metabolome and Metabolomics, Drug discovery and Design, Target identification, Target validation, Lead identification, Lead Optimization, Preclinical Pharmacology and Taxology, Chemoinformatics tools for Drug discovery, Chemical structure representation (SMILE & SMART), Chemical databases: CSD, ACD, WDI, Chembank, PUBCHEM.

#### Books Recommended:

- 1 Orpita Basu & Simminder Kaur, Thakural " Bioinformatics Databases, Tools, Algorithm, 2007 Oxford University Press"
- 2 Higgins, D. Willie, Taylor " Bioinformatics; Sequence, Structure and Data bank, A Practical Approach, 2000, 1st Ed, Oxford University Press
- 3 Allwood T, David Parry Smith; Introduction to bioinformatics, 2008 Pearson Education, Singapore D.ED.
- 4 Murthy, C.S.V., 2016, Himalaya Publishing House
- 5 Ghosh, Z and Mallick, B, 2008, Bioinformatics - Principles and Applications

P. Karan





# BI 103: PRACTICAL

## LIST OF PRACTICALS

1. To explore NCBI.
2. To explore GenBank .
3. To compare data files from NCBI, DDBJ and EMBL.
4. To Perform Sequence alignment using online Blast.
5. To Perform Sequence alignment using offline Blast.
6. To Perform Sequence alignment using Fasta.
7. To Explore PDB.
8. Perform sequence alignment using clustal w.
9. Study phylogenetic relationship using phylip
10. Draw phylogenetic tree using MEGA
11. Find motif using motif search
12. Study drug bank database
13. Explore secondary database prosite and pfam
14. Study OMIM database

(Note: 75% of the practicals from the prescribed list should be completed every year)

### Scheme for Practical Examination

1. Major Exercise	15 Marks
2. Minor Exercise	10 Marks (05+05)
3. Spotting (Related to theory papers)	10
4. Viva-voce Examination	10
5. Lab Journals (Sessionals)	05
<b>TOTAL MARKS</b>	<b>50</b>

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29/6/15



# B.Sc. SECOND YEAR

## THEORY PAPER 3

mm - 40

### BI 201: INTRODUCTION TO COMPUTERS AND PROGRAMMING

**Objective:** To equip students with fundamental knowledge and concepts of Computers and Basic Programming Skills.

#### UNIT I Introduction to Computers

Overview and function of computers, Characteristics of computers, History of Computers, Evolution. Generation of Modern Computers, Classification of Computers, Micro-computers, Mini computers, Main Frame, Super computers, Special purpose computer ( Comparison in their memory, power, cost and Size), PC types, Tower, Desktop, Notebook, Laptops, Handheld, Palmtop, PDA, Types of Modern Computers, Workstations, Servers.

#### UNIT II Computer components and Number System

Components of a computer, Input devices, Output device, CPU, Memories (RAM and ROM), Secondary storage devices, Hard Disk, Magnetic tapes, Zip drives, Digital tapes, CD-ROM, DVD, BluRay, Number system , introduction, Decimal , Binary, Octal, Hexadecimal number systems and their inter conversion.

#### UNIT III Operating system (OS) and software Development

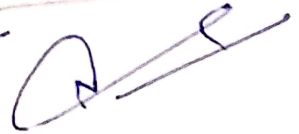
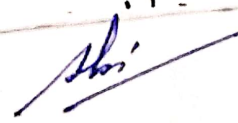
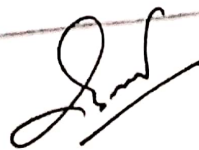
Hardware and Software definitions, Introduction to O/S, Functions, Classification real time, single user single task, single user multi task, Basic description about DOS, WINDOWS, Windows server NT/2000, UNIX/LINUX, MVS, Overview of Software development. Software development phases, problem definition, analysis, algorithm design and representation, coding and debugging (simple description about each phase).

#### UNIT IV Flow charts, Pseudo codes and Programming Languages

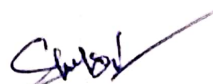
Basic flowchart symbols and their meaning, Pseudo codes, definition and importance, Syntax and Semantics, Programming approaches, Procedural, Object oriented programming languages, Definition, categories, low level languages, Machine language, Assembly language, Advantages and disadvantages, High level languages, Advantages and disadvantages, Interpreters, Compilers and Translators, Overview of compilation process, Types of High level languages. Introduction to Pearl.

#### UNIT V Multimedia and Internet

Multimedia, Introduction, Characteristics, Elements and Applications, The internet and its resources, World Wide Web(WWW), Associated tools, services, resources and various terminologies, An overview of Computer viruses, virus definitions, symptoms, transmission, danger and general precautions.



P. Kishore



**Recommended Books:**

1. Glenn Brookshear J., "Computer Science: An Overview", 2011 11<sup>th</sup> ed, Addison Wesley Publishers.
2. Alexis Leon & Mathews Leon, "Fundamentals of Information Technology". 2009, 2<sup>nd</sup> ed, Vikas Publishing House Pvt. Ltd.
3. Rajaraman V, " Fundamentals of Computer", 2004, 4<sup>th</sup> ed, Prentice Hall India Pvt. Ltd.
4. Francis Glasborrow & Roberta Allen, " A Beginner's Introduction to Computer Programming", 2003, John Wiley and Sons.
5. Anurag Seetha, " Introduction to Computers and Information Technology", 2005 Ram Prasad and Sons Bhopal
6. Basandra S.K., " Computer Today", 2011, 1<sup>st</sup> ed, Ga

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**THEORY PAPER 4****BI 202: STRUCTURAL BIOINFORMATICS**

MM-40

**Objectives:** To understand the levels of structural organization of macro molecules and experimental methods of structural determination. To know the approaches for structural analysis.

**UNIT I Macromolecular structure**

Nucleic acids – DNA and RNA, Protein-Primary, secondary, tertiary and quaternary structures, Amino acids, Ramchandran plot.

**UNIT II Macromolecular Interactions**

Protein-Protein, Protein- Nucleic acid, Protein- Carbohydrates, Structure of Ribosome.

**UNIT III Principles of Protein folding**

Overview of experimental techniques to study macro molecular structure, Methods to study 3D structure – X-ray, NMR, Cryo electron microscopy, Microarray., MALDI-TOFF.

**UNIT IV Proteomics**

Proteomics, Homology modelling, Protein tertiary structure, Prediction, Methodology

**UNIT V Genomics**

Introduction, Genome mapping, assembly annotative and comparison, Comparative Genomics, Free of life and some completed Genomics, Drug research in the era of Genome sequencing.

**Books Recommended:**

- 1 Watson, J.D., Baker, T.A., Bell, S.P. et al., 2008, Molecular Biology of the Gene, Cold Spring Harbor, New York.,
- 2 Sheehan, D. 2010, Physical Biochemistry: Principles and Applications, Wiley Blackwell
- 3 Baxevanis, A.D. and Ouellette, B.F., 2005, Bioinformatics – A Practical Guide to the Analysis of Genes & Proteins, John Wiley & Sons, Inc, USA.



# BI 203: PRACTICAL

## LIST OF PRACTICALS

1. String concatenation
2. Using perl perform translation
3. Using Perl perform transcription
4. Perform parsing of BLAST output and PDB file using perl.
5. To perform C/C++ line/circle Computer Graphic program.
6. Find ORF's in all six reading frames of a given DNA sequence.
7. To access the SCOP database to study protein classification.
8. To access CATH database.
9. To determine similarities and differences between the PDB entries of the protein which have been identified by X-ray crystallography and NMR.
10. To conduct secondary structure prediction using J-Pred secondary structure prediction server.
11. Predict secondary structure using GOR server.
12. Explore HSSP or FSSP databases.

Note: 75% of the practical from the prescribed list should be completed every year)

### Scheme for Practical Examination

1. Major Exercise	15 Marks
2. Minor Exercise	10 Marks (05+05)
3. Spotting (Related to theory papers)	10
4. Viva-voce Examination	10
5. Lab Journals (Sessionals)	05
<b>TOTAL MARKS</b>	<b>50</b>

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B.Sc. III YEAR (BIOINFORMATICS)

~~Semester~~ V I

Session -2017-18

Paper-V—Computer Graphics , Machine Learning and Bioperl

Unit I

M.M. 85

- Color Models: CMY,HSV, RGB, Visualization techniques,
- Graphics display devices, Raster and Random scan devices, color CRT monitors, LCD and LED.
- Generation of lines , circles, Polygons and color filling using standard functions in C.
- Geometric transformations : Rotation, Scaling, Translation (2D)

Unit II

- Artificial Neural networks,
- Genetic algorithm,
- Bayesian Modeling,
- Monte Carlo Simulation method,
- Markov Models and their application.

Unit III

- Perl basic: Variables, Perl operations, A program to store DNA sequence, Concatenating DNA fragment, transcription : DNA to RNA.
- Subroutines, scoping and subroutines,
- Command-line arguments and arrays passing data to subroutines.
- Modules and libraries of subroutines, fixing bugs.

Unit IV

- Random number generators a program using randomization,
- A program to simulate DNA Mutation, generating random DNA, analyzing DNA,
- Hashes, data structures and algorithms for biology, the genetic code.

Unit V

- Translating DNA into proteins reading DNA from files in FASTA format, reading frames,
- Regular expressions, restriction maps and restriction enzymes, Genbank files,
- Genbank libraries, separating sequence and annotation parsing, Annotations indexing, parsing PDB files, parsing BLAST files.
- Concept of Bioperl

Practical List

1. Explore species 2000
2. String concatenation
3. Using perl perform translation
4. Using Perl perform transcription
5. Perform parsing of BLAST output and PDB file using perl.
6. To perform C/C++ line/circle Computer Graphic program.
7. Find out evolutionary relationship using Treeview/phylip package.

Practical Exam Scheme

Any three practicals from the above list each carrying 8 marks

24

06

Spotting

10

Viva

P. Kumar

S. Kumar

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B.Sc. III YEAR (BIOINFORMATICS)

Semester VI II

Session -2017-18

Paper-VI- Informatics in Genomics and application

Unit I

M.M. 85

- Genomics: Genome Annotation, Genome Assembly, Structural and Functional Genomics, Comparative genomics.
- Microarray : technique, Design, Analysis,
- Drug target identification.

Unit II

- System Biology: Introduction, associated disciplines, Interactomics (PPI), Fluxomics, Biomics,
- Metagenomics : Introduction, metagenome, shotgun metagenomics ( pyrosequencing).Tool's in metagenomics, MEGAN, MG-RAST and SEED. Application : gene survey, Environmental genomes, Microbial diversity

Unit III

- Metabolic pathway database (KEGG pathway database), Concept of metabolome and metabolomics,
- Drug Discovery and Design: Target identification, target Validation, Lead Identification, Lead Optimization, preclinical Pharmacology & toxicology.

Unit IV

- Chemoinformatics : Chemoinformatics tools for drug discovery, Chemical Structure Representation (SMILE & SMART),
- Chemical databases : CSD, ACD, WDI, ChemBank, hazardous chemical database, PUBCHEM

Unit V

- Quantitative Structure Activity Relationship ( 2D & 3D), Combinatorial libraries & their design,
- High throughput screening, virtual screening, Lipinski's rule of five,
- Phylogeny, Introduction to phylogenetic analysis, Concept of Phylogenetic tree.

Practical List

1. Explore Kegg Database
2. Explore Drug bank database
3. Explore Pubchem database
4. Explore MG-RAST and SEED
5. Access to the latest curated datasets using SEED viewer
6. Generate a chemical structure using SMILE ( Pubchesketcher)

Practical Exam Scheme

Any three practicals from the above list each carrying 8 marks	24
Spotting	06
Viva	10
Practical record/collection	5+5

P. Kumar  




**Career oriented Program  
Certificate Course In Bioinformatics**

**Preamble:**

Bioinformatics is the newly branch in the field of life sciences. It is information technology applied to the management and analysis of biological data with the aid of computers. It is the science of using information to understand biology. It is a field in which biological information collected, compared, studies and analyses to find the interrelation between them for solving structural, functional and evolutionary problems using computational technologies. The biological information stored in various databases is available online through internet. Bioinformatics refers to the creation and advancement of databases.

In the recent years in this age of internet and sequenced genome, we have more information at our finger tips than ever before. Organizing this entire data and combating information overload is becoming more and more important. The advent of genetic engineering vastly increased size of information.

**Scope:**

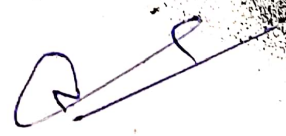
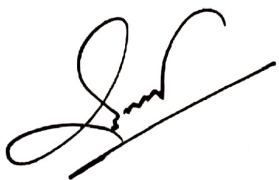
Protein sequencing, Nucleic acid sequencing and their analysis.

- Find proteins, their activity, interactions, modifications and functions.
- Elucidation of function of a molecule based on its structure.
- Gene expression, analysis, prediction and establish genomic library
- Find homology for studying evolutionary relationship among different species.
- Molecular modelling and molecular dynamics methods to study structure from sequence.

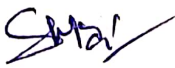
**Intake capacity: 20 Students**

**Eligibility: B.Sc./M.Sc. degree in Science ( Physical, Mathematical, Chemical, Life Sciences).**

**Course Fee: Rs. 2000 + Examination Fee**



P. Kulkarni



## Course Structure:

### Paper I Bioinformatics and Approach

Module I: Overview of applications of Biotechnology and Microbiology

History of Biotechnology, Recombinant DNA technology and its applications in agriculture, environment and health.

Applications of Microbiology, Human Genome Project

Module II : Introduction to Bioinformatics

Definition, history and current prospective, Interfaces of Bioinformatics. Applications of Bioinformatics, Information technology and Bioinformatics, Role of Computers

Module III : Biological databases

Introduction, Types of data and databases, Genomic database, Gene Bank, EMBL, DDBJ, Protein databases, Open access and open sources, PUB MED, Biomed Central, NCBI, EBI, Expasy, RCB, Bioinformatics glossary.

Module IV : Genomic databases.

Viral genome database, genome online database (GOLD), Microbial genome database (MBGD), Genome browser, ENSEMBL, VEGA, Genome browser, Database search engines-ENTREZ, SRS, Sequence similarity bas search engine, BLAST, BLAST

Module V : Computer fundamentals and applications

History, Input and Output device, memory devices, communication technology, networking services, LAN, WAN and MAN, uses of internet and multimedia.

### Paper II Concept of Bioinformatics, Bioethics and IPR

Module I: Structural Bioinformatics

Structure of DNA/RNA,

Proteins, Primary, Secondary, Tertiary structure.

Module II: Techniques of Molecular Structure Determination

NMR, Crystallography, CD, MALDI-TOF, Gel electrophoresis

Module III: Sequence alignment

Basic concept of sequence similarity,

Pairwise sequence alignment, multiple sequence alignment, Gap penalties

Module IV: Genomics

Introduction, Genome mapping, Comparative Genomics, Tree of Life, Drug research in post genomic era , Genome sequencing.

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Module V: Bioethics and IPR

Regularity procedure, Good laboratory practices , Regulation for DNA, research and manufacturing process, Biosafety and Bioethics, Rules for import and Export of Biological material, GMO and GM-food.

IPR, Definition, forms, patents, copyrights, trademarks, designs, Importance in Indian scenario, Laws in India for IPR protection

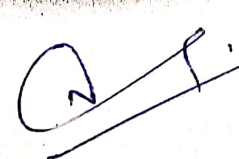
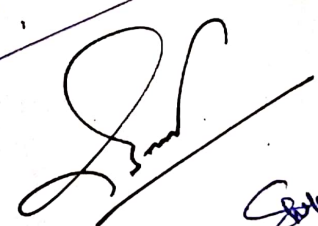

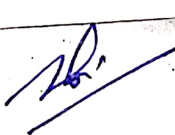
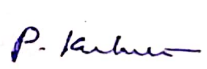
**Books /References**

1. Introduction to Bioinformatics, Atwood T.K. and Smith, D.J.
2. An Introduction to Computational Biochemistry, C. Stain Tsai, A. John, Wiley and Sons, Inc. Publications.
3. Bioinformatics; Methods and Applications; Genomics, Proteomics and Drug Discovery, Rastogi S.C., Mendiratta and Rastogi P.
4. Bioinformatics; A practical Guide to the analysis of genes and proteins; edited by Andreas D. Baxevanis and Francis Oulelette.
5. <http://www.ncbi.nlm.nih.gov>
6. Developing Bioinformatics Computer Skill, Cynthi Gibas and Per Jambeck

**BIOINF LAB.**

1. Computer basic knowledge; hardware, connection cables, typing, window XP/7/8. Internet browsers, search engines.
2. LAN connection, setting up the IP address, network security.
3. Internet surfing and searching information, downloading and installing software ( Acrobat Reader etc)
4. Hands on training with Microsoft Word, Excel
5. Creation of Computer presentation with MS Power Point.
6. Introduction to C language and Oracle for creation of database.
7. Introduction to literature database at NCBI and querying the PUBMED database using the ENTREZ search engine.
8. Getting the amino acid sequences by exploring and querying the protein sequence database.
9. Getting the gene sequences by exploring and querying the nucleic acid datab~~ase~~
10. 3-D Protein structure visualization and measurement of bond length, bond angles and torsional angles using RasMol.
11. Secondary and tertiary structural analysis.

**Project Work :**



# BIOINFORMATICS

(UG Self Finance Course) 2019-20

## LIST OF EXAMINERS

S.No.	Name	Address	Mobile No.
1	Prof Shashi Chauhan	Retd Prof SOS in Botany Gwl	
2	Prof. Rekha Bhadoriya	Retd Prof SOS in Botany Gwl	
3	Prof. R M Agrawal	Retd Prof SOS in Botany Gwl	
4	Prof. Avinash Tiwari	Prof SOS in Botany Gwl	
5	Prof. M K Gupta	Prof SOS in Botany Gwl	
6	Dr. Susheel Manderiya	SOS in Botany Gwl	
7	Dr, Sapan Patel	SOS in Botany Gwl	
8	DR Archana Shrivastava	CHRI Gwalior	
9	Dr RAS Chauhan	PG College Ambah	
10	Dr. B M Kulshrestha	Retd, KRG College Gwalior	
11	Prof Madhu L Sharma	KRG College Gwalior	
12	Prof Sadhna Pandey	KRG College Gwalior	
13	Mrs. Charanjit Mehta	VRG College Gwalior	
14	Dr. Preeti Kulshrestha	KRG College Gwalior	
15	Dr. S H Qureshi	Jhalkari Bai College Gwl	
16	Dr Rakesh Kushwaha	Bhagwat Sahai College Gwl	
17	Dr AC Raghuvanshi	Science College Gwalior	
18	Dr. Hariom Sharma	Science College Gwalior	
19	Dr R K Khare	Science College Gwalior	
20	Dr VK Sewaria	Science College Gwalior	
21	Dr DP Sharma	Science College Gwalior	
22	Dr PP Deo	Science College Gwalior	
23	Prof. Deep Azad	SLP College Gwalior	
24	Dr BB Gupta	SLP College Gwalior	
25	Dr JK Mishra	PG College Morena	
26	Dr RP Singh	PG College Morena	
27	Dr SK Raina	Retd Prof PGV College Gwl	
28	Dr Rajbeer Singh	KK College Etawah	
29	Dr Reena Jain	Boston College Gwl	
30	Dr Madhu Gupta	CHRI Gwalior	
31	Dr Usha Duseja	CHRI Gwalior	
32	Dr Kusum Kashyap	Govt Girls College Chhatarpur	
33	Dr KK Dubey	Retd. Prof	
34	Dr Shushil Sharma	Scientist, DRDO Gwalior	
35	Prof Ragini Gothwal	Barkatullah Uni, Bhopal	
36	Dr Surnahi Shrivastava	Gargi College Delhi	
37	Dr Sangeeta Shrivastava	Pri. Sci. Indian Institute of Sugarcane research Lucknow	
38	Dr Sanjeev Kumar	Pri. Sci. Indian Institute of Sugarcane research Lucknow	
39	Dr. Alka Pandey	Govt. PG College, Betul	
40	K N Bhardwaj		

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*[Signature]*  
P. Kumar

**Career oriented Program**  
**Certificate Course in Bioinformatics**

**Preamble:**

Bioinformatics is the newly branch in the field of life sciences. It is information technology applied to the management and analysis of biological data with the aid of computers. It is the science of using information to understand biology. It is a field in which biological information collected, compared, studies and analyses to find the interrelation between them for solving structural, functional and evolutionary problems using computational technologies. The biological information stored in various databases is available online through internet. Bioinformatics refers to the creation and advancement of databases.

In the recent years in this age of internet and sequenced genome, we have more information at our finger tips than ever before. Organizing this entire data and combating information overload is becoming more and more important. The advent of genetic engineering vastly increased size of information.

**Scope:**

Protein sequencing, Nucleic acid sequencing and their analysis.

- Find proteins, their activity, interactions, modifications and functions.
- Elucidation of function of a molecule based on its structure.
- Gene expression, analysis, prediction and establish genomic library.
- Find homology for studying evolutionary relationship among different species.
- Molecular modelling and molecular dynamics methods to study structure from sequence.

**Intake capacity:** 20 Students

**Eligibility:** B.Sc./M.Sc. degree in Science ( Physical, Mathematical, Chemical, Life Sciences),

**Course Fee:** Rs. 2000 + Examination Fee

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**Career oriented Program**  
**Certificate Course in Bioinformatics**

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## Course Structure:

### Paper I Bioinformatics and Approach

Module I: Overview of applications of Biotechnology and Microbiology

History of Biotechnology, Recombinant DNA technology and its applications in agriculture, environment and health.

Applications of Microbiology, Human Genome Project

Module II : Introduction to Bioinformatics

Definition, history and current prospective, Interfaces of Bioinformatics. Applications of Bioinformatics, Information technology and Bioinformatics, Role of Computers

Module III : Biological databases

Introduction, Types of data and databases, Genomic database, Gene Bank, EMBL, DDBJ, Protein databases, Open access and open sources, PUB MED, Biomed Central, NCBI, EBI, ExPASy, RCSB, Bioinformatics glossary.

Module IV : Genomic databases.

Viral genome database, genome online database (GOLD), Microbial genome database (MBGD), Genome browser, ENSEMBL, VEGA, Genome browser, Database search engines-ENTREZ, SRS, Sequence similarity bas search engine, BLAST, BLAST

Module V : Computer fundamentals and applications

History, Input and Output device, memory devices, communication technology, networking services, LAN, WAN and MAN, uses of internet and multimedia.

### Paper II Concept of Bioinformatics, Bioethics and IPR

Module I: Structural Bioinformatics

Structure of DNA/RNA,

Proteins, Primary, Secondary, Tertiary structure.

Module II: Techniques of Molecular Structure Determination

NMR, Crystallography, CD, MALDI-TOF, Gel electrophoresis

Module III: Sequence alignment

Basic concept of sequence similarity,

Pairwise sequence alignment, multiple sequence alignment, Gap penalties

Module IV: Genomics

Introduction, Genome mapping, Comparative Genomics, Tree of Life, Drug research in post genomic era , Genome sequencing.

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### Module V: Bioethics and IPR

Regularity procedure, Good laboratory practices, Regulation for DNA, research and manufacturing process, Biosafety and Bioethics, Rules for import and Export of Biological material, GMO and GM-food.

IPR, Definition, forms, patents, copyrights, trademarks, designs, Importance in Indian scenario, Laws in India for IPR protection

### **Books /References**

1. Introduction to Bioinformatics, Atwood T.K. and Smith, D.J.
2. An Introduction to Computational Biochemistry, C. Stain Tsai, A. John, Wiley and Sons, Inc. Publications.
3. Bioinformatics; Methods and Applications; Genomics, Proteomics and Drug Discovery, Rastogi S.C., Mendiratta and Rastogi P.
4. Bioinformatics; A practical Guide to the analysis of genes and proteins; edited by Andreas D. Baxevanis and Francis Oulelette.
5. <http://www.ncbi.nlm.nih.gov>
6. Developing Bioinformatics Computer Skill, Cynthi Gibas and Per Jambeck

### **BIOINF LAB.**

1. Computer basic knowledge; hardware, connection cables, typing, window XP/7/8. Internet browsers, search engines.
2. LAN connection, setting up the IP address, network security.
3. Internet surfing and searching information, downloading and installing software ( Acrobat Reader etc)
4. Hands on training with Microsoft Word, Excel
5. Creation of Computer presentation with MS Power Point.
6. Introduction to C language and Oracle for creation of database.
7. Introduction to literature database at NCBI and querying the PUBMED database using the ENTREZ search engine.
8. Getting the amino acid sequences by exploring and querying the protein sequence database.
9. Getting the gene sequences by exploring and querying the nucleic acid database.
10. 3-D Protein structure visualization and measurement of bond length, bond angles and torsional angles using RasMol.
11. Secondary and tertiary structural analysis.

Project Work :

*Qy*  
28-6-16

*Mr*

*Abhinav*  
28/06/16

*Mr*  
28/06/16





कार्यालय प्राचार्य, शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय, ग्वालियर  
GOVT. KAMLA RAJA GIRLS P.G. AUTO. COLLEGE, GWALIOR (M.P.) INDIA  
(Affiliated to Jiwaji University, Gwalior under 2(f) & 12(b) NAAC - 'A' Grade Accredited Institute)  
www.krgcgwalior.org krgc@rediffmail.com Phone : 0751- 2625495, 0751-2438173

क्र. 777-22(बायोइंफो) / अका.प्र. / अध्ययनमंडल / 2019-20

ग्वालियर, दिनांक 12 जून, 2019

अधिसूचना

स्वशासी महाविद्यालय हेतु विश्वविद्यालय अनुदान आयोग दिल्ली द्वारा जारी दिशा निर्देश की कंडिका 8 परिशिष्ट 5 में वर्णित प्रावधान अनुसार गठित बायोइंफोर्मेटिक्स विषय के अध्ययन मंडल की बैठक दिनांक 29 जून, 2019, शनिवार को प्रातः 11 बजे बायोइंफोर्मेटिक्स विभाग में आयोजित की गई है। अतः आप अध्ययनमंडल की बैठक में उपस्थित होकर पाठ्यक्रम एवं अन्य अकादमिक-शोध संबंधी विकास के प्रस्तावों को तैयार करने में अपना सुझाव एवं सहयोग प्रदान करें।

- |     |          |   |           |  |
|-----|----------|---|-----------|--|
| (अ) | श्रेणी-1 | - | अध्यक्ष : | डॉ. साधना पाण्डेय, समन्वयक   |
| (ब) | श्रेणी-2 | - | सदस्य :   | डॉ. मधुलक्ष्मी शर्मा<br>डॉ. प्रीति कुलश्रेष्ठ  |
| (स) | श्रेणी-3 | - | सदस्य :   | डॉ. एस. एच. कुरैशी, शा. स्ना. महा. शिक्षणुदा<br>डॉ. शक्ति भारद्वाज, शा. आदर्श विज्ञान महा. ग्वालियर                          |
| (द) | श्रेणी-4 | - | सदस्य :   | डॉ. जी.बी.के.एस. प्रसाद, बायोकेमिस्ट्री, अध्ययनशाला,<br>जीवाजी विश्वविद्यालय, ग्वालियर                                       |
| (इ) | श्रेणी-5 | - | सदस्य :   | निरंक  |
| (य) | श्रेणी-6 | - | सदस्य :   | डॉ. वेद प्रकाश श्रोत्रिय, शा. आदर्श विज्ञान महा.<br>ग्वालियर<br>डॉ. किशोर शिंदे, बरकतउल्ला वि.वि., ग्वालियर<br>डॉ. विशाल कदम |

(प्रो. संजय स्वर्णकार)  
अकादमिक सचिव

M. Dubey  
12/6/19

(डा. मंजू दुबे)

प्रभारी प्राचार्य

शा. कमलाराजा कन्या स्ना. स्वशासी महा.  
ग्वालियर (म.प्र.)

प्रतिलिपि :

1. अध्यक्ष, अध्ययन मंडल, बायोइंफोर्मेटिक्स विषय की ओर सूचनार्थ एवं निर्देश कि समस्त सदस्यों को दूरभाष अथवा ईमेल अथवा व्हाट्सएप के माध्यम से बैठक की सूचना यथासमय उपलब्ध करायें।
2. समस्त सदस्य, अध्ययन मंडल, बायोइंफोर्मेटिक्स विषय की ओर सूचनार्थ।

(प्रो. संजय स्वर्णकार)  
अकादमिक सचिव

M. Dubey  
12/6/19

(डा. मंजू दुबे)

प्रभारी प्राचार्य

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ग्वालियर (म.प्र.)

