



## MINUTES OF MEETING

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Molecular Modelling Lab

**Date:** 26/04/2017

**Agenda:** Opinion/Suggestion for improvement of syllabus

The following are the members present in the meeting.

**Dr. Naveen Prasad (Dean)**

Internal (Department Members):

1. Dr. Jaynthy Chellam, Associate Professor and Head
2. Dr. Jemmy Christy, Assistant Professor
3. Dr. K. Balasankar, Assistant Professor
4. Dr. T. Arun Kumar, Assistant Professor

Internal Members (Faculty):

1. Dr. D. Alex Anand, Associate Professor & Head, Biomedical Department
2. Dr. Valli Nachiyar, Associate Professor & Head, Biotechnology Department.
3. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.
4. Dr. Swetha Sunkar, Assistant Professor, Bioinformatics Department.
5. Ms. Renuga, Assistant Professor, Biotechnology Department.

Internal Members (Physics):

1. Dr. M.Xavier Suresh, Associate Professor, Physics Department.
2. Dr. Sampath Kumar, Associate Professor, Physics Department

The Members of the Board approved the present syllabus with the following suggestions in three papers.

- a. INTRODUCTION TO QUANTUM CHEMISTRY SBI1204 (IV Semester)

In this course, following changes are to be included in the unit III. The significance of Born Interpretation of the wave function has to be included in the syllabus as per the feedback obtained from Dr. Jaynthy.C, Dr. M. Xavier Suresh and Dr. Sampath Kumar, Physics department. Hence

the following topics will be included and implemented for the students of B. Tech Bioinformatics, Batch 2016-2020 onwards

b. BIOMOLECULAR INTERACTION SBI1201 (III Semester)

The course describes the importance of the different types of interactions among biomolecules. Here, the third unit focuses on GNR map and its importance in analyzing proteins structurally. In this unit, following changes are to be made: 3rd unit can be changed by including the following new topics: "Interaction specificity, Modeling and manipulating biomolecular interactions" and removing the following "Distribution of ( $\phi$ ,  $\psi$ ) values observed in high resolution protein structures". The inputs were given by Dr. Jaynthy. C, Dr. Valli Nachiyar and Dr. Jayshree Nellore of Biotechnology department.

Hence the following topics will be included and implemented for the students of B. Tech Bioinformatics, Batch 2016-2020 onwards

c. BIOLOGICAL SEQUENCE ANALYSIS SBI1202 (III Semester)

The course has an objective of analyzing the nature of the sequences and the feedback on this course is, considering the importance of the emerging new topic, Next Generation Sequencing, it is apt to include this topic in the curriculums an introduction. Hence, the second and third unit can be merged and some topics can be removed, if required. Also, the new unit III, with the topic Next Generation Sequencing. Suggestions were given by Dr. K. Balasankar, Dr. D. Alex Anand, Dr. Jaynthy.C and Dr. Jemmy Christy.

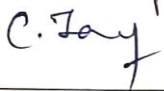
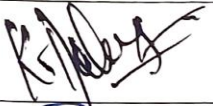
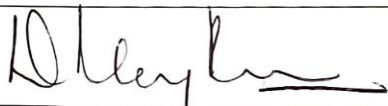
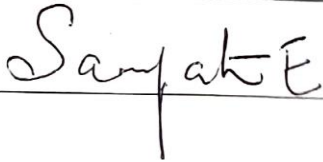
Hence the following topics will be included and implemented for the students of B. Tech Bioinformatics, Batch 2016-2020 onwards

- The members also suggested to train the students in practical aspects of certain concepts.
- Based on this suggestion hands on courses on microarray analysis has been suggested and would be expected to be implemented in the next academic year

**Minutes approved**

## Signature of the Participants

### Signature of the Members

| Name                 | Signature                                                                            |
|----------------------|--------------------------------------------------------------------------------------|
| Dr. Naveen Prasad    |    |
| Dr. JaynthyChellam   |     |
| Dr. Jemmy Christy    |    |
| Dr. K. Balasankar    |     |
| Dr. T. Arun Kumar    |     |
| Dr. D. Alex Anand    |   |
| Dr. ValliNachiyar    |   |
| Dr. Jayshree Nellore |   |
| Dr. Swetha Sunkar    |   |
| Ms. Renuga           |   |
| Dr. M. Xavier Suresh |  |
| Dr. Sampath Kumar    |  |



# **SATHYABAMA**

## **INSTITUTE OF SCIENCE AND TECHNOLOGY**

(DEEMED TO BE UNIVERSITY)



Accredited with "A" grade by NAAC

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119, Tamilnadu, India.

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### **MINUTES OF MEETING**

**Subject: Board of Studies- Department of Bioinformatics**

**Venue: Molecular Modelling Lab**

**Date: 20 /11/2017**

**Agenda: Opinion/suggestion for improvement of syllabus**

**The following are the members present in the meeting.**

1. Dr. Anima Nanda (Dean).

#### **Internal (Department Members):**

1. Dr. Jaynthy Chellam, Associate Professor
2. Dr. Jemmy Christy, Assistant Professor
3. Dr.D.Alex Anand, Assistant Professor
4. Dr. Balasankar, Assistant Professor
5. Dr. Swetha Sunkar, Assistant Professor

#### **Internal Members (Faculty):**

1. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department
2. Dr. Valli Nachiyar, Associate Professor, Biotechnology Department.
3. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.
4. Ms. Renuga, Assistant Professor, Biotechnology Department.

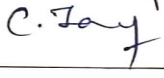
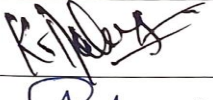
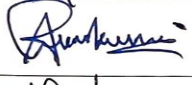
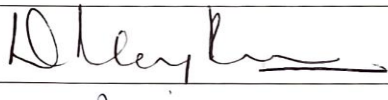
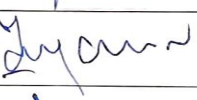
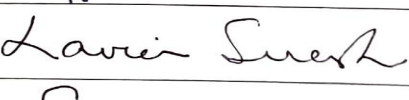
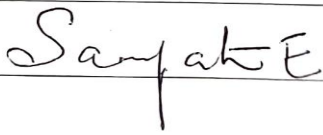
**The Board of studies approved the present syllabus with the following suggestions.**

- a. In the paper, SBI1203 - Molecular Immunology and Immunoinformatics the unit V (Immunoinformatics) of the paper, the tools and databases are to be learnt by the student. It was suggested to increase the number of tools listed thereon. The specific tools suggested were – CED, BCPEP, IEDB, SYFPEITHI, SDAP, Immunome database and AllergenPro.
- b. In the paper, SBI1205, Phylogenetic analysis, it was suggested to move the tools listed in the first unit, namely ClustalW, BioEdit, HMMER, T-coffee, MAFFT, MultiAlign to the fifth unit.

## Minutes approved

### Signature of the Participants

#### Signature of the Members

| Name                | Signature                                                                            |
|---------------------|--------------------------------------------------------------------------------------|
| Dr. Naveen Prasad   |    |
| Dr. JaynthyChellam  |     |
| Dr. Jemmy Christy   |    |
| Dr. K. Balasankar   |     |
| Dr. T. Arun Kumar   |     |
| Dr. D. Alex Anand   |    |
| Dr. ValliNachiyar   |    |
| Dr.Jayshree Nellore |    |
| Dr.SwethaSunkar     |   |
| Ms.Renuga           |   |
| Dr.M.Xavier Suresh  |  |
| Dr.Sampath Kumar    |  |



# SATHYABAMA

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## SCHOOL OF BIO AND CHEMICAL ENGINEERING

### DEPARTMENT OF BIOINFORMATICS

#### BOARD OF STUDIES - MINUTES OF MEETING

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Conference Hall, Administrative Block, Sathyabama Institute of Science & Technology, Chennai- 119

**Date:** 3/04/2019

**Agenda:** Opinion/suggestion for improvement of syllabus;  
UG courses – F.N.; PG courses – A.N.

The following are the members present in the meeting.

External members:

1. Dr. Karthik Raman, Associate Professor, Department of Biotechnology, IIT Madras
2. Dr. Anbumani, Microbiology SRMC, Chennai
3. Dr. S. Mahalingam, Professor Indian Institute of Technology Madras

Internal (Department Members):

1. Dr. Jaynthy Chellam, Associate Professor
2. Dr. Jemmy Christy, Assistant Professor
3. Dr. D. Alex Anand, Assistant Professor
4. Dr. Balasankar, Assistant Professor
5. Dr. Swetha Sunkar, Assistant Professor

Internal Members (Faculty):

1. Dr. Anima Nanda, Professor, IQAC Coordinator
2. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department
3. Dr. Valli Nachiyar, Associate Professor, Biotechnology Department.
4. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.
5. Dr. Antony Samrot, Associate Professor, Biotechnology Department.
6. Ms. Renuga, Assistant Professor, Biotechnology Department.

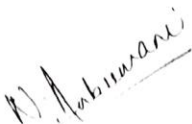
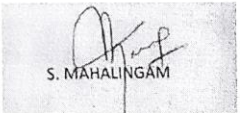
The BOS meeting has been convened today **3<sup>rd</sup> April**, 2019 to frame the new curriculum and syllabi for the Faculty of Bio & Chemical Engineering to be implemented from the Academic year 2019-20.

- The Chairman Dr. **Wilson Aruni** greeted and welcomed all members of Board of Studies. The HoDs of Dept. of Biomedical Eng, Biotechnology, Bioinformatics, and Chemical Engineering along with the Staff members under the School of Bio & Chemical Engineering, attended the meeting to have an effective interaction with the members and make the efforts in fruitful manner.
- New courses were introduced by the Department of Bioinformatics which includes B.Sc (Bioinformatics and Datascience) and M.Sc (Bioinformatics and Datascience) from the academic year 2019 for which the syllabus designed was evaluated.
- The syllabus revision is done as a whole for all UG and PG courses of the School of Bio & Chemical Engineering which includes B.Tech (BTE), M.Tech. (BTE), M.Sc. (Biotech), M. Phil. (Biotech) offered by the **Department of Biotechnology**, B.Tech (BME), M.Tech. (Med. Inst.), offered by the **Department of Biomedical Engineering**, and B.Tech (CHEM), M.Tech. (CHEM), offered by the **Department of Chemical Engineering**.
- Dr. **Wilson Aruni** started the meeting by giving an over view about the University from its inception and various courses being offered by the University. She described about the process of syllabus revision by enumerating various steps that were adopted by the University in bringing out a new syllabus.
- B.Sc (Bioinformatics and Datascience) syllabus comprised of 27 theory papers and 10 practical paper with total credits being 123. M.Sc (Bioinformatics and Datascience) comprised of 15 theory and 9 practical papers with total credits being 70 and is presented to Board of Studies for approval.
- A copy of the syllabi framed by the Internal BOS members was sent a month in advance to the External Members according to their specialization and field of expertise for their review. Their valuable suggestions and comments were received well before the meeting and modifications have been carried out and kept before the members today for further discussions.
- The suggestions which were received during review by External BOS members were placed before the full board for subsequent modifications were discussed exhaustively in the meeting.

- The content of syllabus for each subject was discussed in detail, taking into consideration of the prerequisite knowledge, references of syllabi followed in other premier Universities and feedback obtained from Industries, Recruiters, Alumni and other experts in that subject.
- The topics in each subject were carefully scrutinized to have relevance to the latest technologies.
- The members also gave their suggestions of the Text books and Reference books that could be included along with the existing list of books.
- The members suggested that B.Sc students can also take up internships that would cater to understanding the industrial requirement.
- The Board members finally reviewed the changes that have been implemented as per the discussions held.
- All their suggestions and comments have been noted and corresponding alterations were done in the syllabi.
- The External Members appreciated the content as well as the depth of syllabi in the curriculum.
- The Internal marks of 50 and External marks of 50 for each subject has been agreed in total and appreciated by all the members.
- The closing meeting was chaired by the Vice Chancellor of the Institution and the vote of thanks was proposed by the Pro Vicechancellor.

**Minutes approved.**

**Signature of the Members**

| <b>External Members</b>                                                                              | <b>Signature</b>                                                                                   | <b>Internal Members</b>                                                                                                                   | <b>Signature</b>                                                                      |
|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Dr. Anbumani</b><br>Microbiology<br>SRMC, Chennai                                                 |                   | <b>Dr. Wilson Aruni,</b><br>Pro Vicechancellor,<br>Sathyabama Institute of<br>Science<br>& Technology                                     |    |
| <b>Dr. Karthik Raman</b><br>Associate<br>Professor,<br>Department of<br>Biotechnology, IIT<br>Madras | <br>Karthik Raman | <b>Dr. Jemmy Christy</b><br>Assistant Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology     |    |
| <b>Dr. S. Mahalingam</b><br>Professor<br>Indian Institute of<br>Technology<br>Madras                 | <br>S. MAHALINGAM | <b>Dr. Swetha Sunkar</b><br>Assistant Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology     |    |
|                                                                                                      |                                                                                                    | <b>Dr. Jaynthy Chellam</b><br>Associate Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology   |   |
|                                                                                                      |                                                                                                    | <b>Dr. Daniel Alex Anand</b><br>Associate Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology |  |



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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOINFORMATICS

## BOARD OF STUDIES - MINUTES OF MEETING

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Conference Hall, Administrative Block, Sathyabama Institute of Science & Technology, Chennai- 119

**Date:** 14/11/2019

**Agenda:** Opinion/suggestion for improvement of syllabus;  
UG courses – F.N.; PG courses – A.N.

The following are the members present in the meeting.

External members:

1. Dr. Karthik Raman, Associate Professor, Department of Biotechnology, IIT Madras
2. Dr. Anbumani, Microbiology SRMC, Chennai
3. Dr. S. Mahalingam, Professor Indian Institute of Technology Madras

Internal (Department Members):

4. Dr. Jaynthy Chellam, Associate Professor
5. Dr. Jemmy Christy, Assistant Professor
6. Dr. D. Alex Anand, Assistant Professor
7. Dr. Balasankar, Assistant Professor
8. Dr. Swetha Sunkar, Assistant Professor

Internal Members (Faculty):

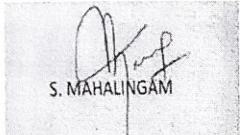
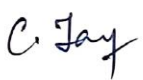
9. Dr. Anima Nanda, Professor, IQAC Coordinator
10. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department
11. Dr. Valli Nachiyar, Associate Professor, Biotechnology Department.
12. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.
13. Dr. Antony Samrot, Associate Professor, Biotechnology Department.
14. Ms. Renuga, Assistant Professor, Biotechnology Department.

The BOS meeting has been convened today 14th November, 2019 to pass the newly framed curriculum and syllabi for the Faculty of Bio & Chemical Engineering to be implemented from the Academic year 2019-20.

- The Chairman Dr. **Wilson Aruni** greeted and welcomed all members of Board of Studies. The HoDs of Dept. of Biomedical Engg, Biotechnology, Bioinformatics, and Chemical Engineering along with the Staff members under the School of Bio & Chemical Engineering, attended the meeting to have an effective interaction with the members and make the efforts in fruitful manner.
- This suggestion / amendment was put forth and seconded by three members of the board to increase the number of databases covered in the first semester lab paper SBIA2102 Biological Databases Lab. The databases suggested to be included were – SRA, NGS catalogue, NGS content database and the GWAS catalogue.
- In the second semester paper, SBIA 1201 (Sequence analysis), it was suggested to add newer reference material to text / reference books.
- It was also suggested to add a list of tools like MESQUITE, HYPHY, ADMIX tools, BEAST, Geneious to the list of tools to be covered in the fifth unit of SBIA1302 (Evolutionary biology) paper.

**Minutes approved.**

**Signature of the Members**

| <b>External Members</b>                                                                               | <b>Signature</b>                                                                                    | <b>Internal Members</b>                                                                                                                   | <b>Signature</b>                                                                      |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Dr. Anbumani</b><br>Microbiology<br>SRMC, Chennai                                                  |                    | <b>Dr. Wilson Aruni,</b><br>Pro Vicechancellor,<br>Sathyabama Institute of<br>Science<br>& Technology                                     |    |
| <b>Dr. Karthik Raman</b><br>Associate<br>Professor,<br>Department of<br>Biotechnology, II<br>T Madras | <br>Karthik Raman  | <b>Dr. Jemmy Christy</b><br>Assistant Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology     |    |
| <b>Dr. S. Mahalingam</b><br>Professor<br>Indian Institute of<br>Technology<br>Madras                  | <br>S. MAHALINGAM | <b>Dr. Swetha Sunkar</b><br>Assistant Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology     |   |
|                                                                                                       |                                                                                                     | <b>Dr. Jaynthy Chellam</b><br>Associate Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology   |  |
|                                                                                                       |                                                                                                     | <b>Dr. Daniel Alex Anand</b><br>Associate Professor<br>Department of<br>Bioinformatics Sathyabama<br>Institute of Science<br>& Technology |  |



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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOINFORMATICS

BOARD OF STUDIES - MINUTES OF MEETING

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Molecular Modelling Lab

**Date:** 14/06/2019

**Agenda:** Opinion/suggestion for improvement of syllabus

Department Members:

1. Dr. Jemmy Christy, Assistant Professor
2. Dr. Jaynthy, Associate Professor
3. Dr. Alex Anand, Associate Professor
4. Dr. Swetha Sunkar, Assistant Professor
5. Dr. Balasankar, Assistant Professor

Internal Members (Faculty):

6. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department
7. Dr. Valli Nachiyar, Associate Professor, Biotechnology Department.
8. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.
9. Ms. Renuga, Assistant Professor, Biotechnology Department

The BOS meeting has been convened by the department HOD to discuss any changes that can be carried out in the syllabus.

- The Department initiated B. Sc and M. Sc courses for which the syllabus was framed and approved.
- More focus was to be laid on skill development for students and hence certain certification programs were suggested.
- Training on molecular simulation was suggested as there was a need for students to improvise their skill.
- Immunoinformatics was also suggested as they had theory paper.
- Matlab is essential for analysis and hence this course was suggested.

- In the current scenario, big data gained popularity and students need to have an understanding for which an introduction on this course was also suggested. - Introduction to big data

The members decided to develop the course module and schedule the courses in this academic year.

### Minutes approved

#### Signature of the participants

| Name                | Signature     |
|---------------------|---------------|
| Dr.JaynthyChellam,  | C. Jay        |
| Dr. Jemmy Christy   | J             |
| Dr.D.AlexAnand      | D. Alex Anand |
| Dr.Balasankar       | K. Balasankar |
| Dr.SwethaSunkar     | Swetha        |
| Dr. Ramesh Kumar    | Ramesh Kumar  |
| Dr.ValliNachiyar    | V. Nachiyar   |
| Dr.Jayshree Nellore | Jayashree     |
| Ms.Renuga           | Renuga        |



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DEPARTMENT OF BIOINFORMATICS

BOARD OF STUDIES - MINUTES OF MEETING

## MINUTES OF MEETING

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Molecular Modelling Lab

**Date:** 15/11/2019

**Agenda:** Opinion/suggestion for improvement of syllabus

Department Members:

1. Dr. Jemmy Christy, Assistant Professor
2. Dr. Jaynthy, Associate Professor
3. Dr. Alex Anand, Associate Professor
4. Dr. Swetha Sunkar, Assistant Professor
5. Dr. Balasankar, Assistant Professor

Internal Members (Faculty):

6. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department
7. Dr. Valli Nachiyar, Associate Professor, Biotechnology Department.
8. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.
9. Ms. Renuga, Assistant Professor, Biotechnology Department

The BOS meeting has been convened by the department HOD to discuss any changes that can be carried out in the syllabus.

- Training on molecular simulation was suggested and implemented.
- It was suggested to include proteomic tools and databases in the paper SBIA1303 Proteomics and interactions that include – 2D PAGE, Dynamic Proteomics, EXPASY Proteome tool collection, Entrez Protein, HGPD and the UCSC Proteome browser in the first unit.
- It was proposed to include structural biology tools and databases in the fifth unit of the unit of the paper on SBIA1401 Structural biology. The suggested databases were RCSB PDB, PDB Europe, at EBI, PDB Japan, Metalloprotein

database, BMRDB (Biological Magnetic Resonance Data Bank), BIOISIS: Database of SAXS of Biological macromolecules and SASBDB: Small Angle Scattering Biological Data Bank.

### Minutes approved

#### Signature of the participants

| Name                | Signature     |
|---------------------|---------------|
| Dr.Jaynthychellam,  | C. Jay        |
| Dr. Jemmy Christy   | J. Christy    |
| Dr.D.AlexAnand      | Alex Anand    |
| Dr.Balasankar       | K. Balasankar |
| Dr.SwethaSunkar     | Swetha        |
| Dr. Ramesh Kumar    | Ramesh Kumar  |
| Dr.ValliNachiyar    | V. Nachiyar   |
| Dr.Jayshree Nellore | Jayshree      |
| Ms.Renuga           | Renuga        |



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**DEPARTMENT OF BIOINFORMATICS**

**BOARD OF STUDIES - MINUTES OF MEETING**

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Molecular Modelling Lab

**Date:** 26/06/2020

**Agenda:** Opinion/suggestion for improvement of syllabus

#### **External member**

**Dr. C Elizabeth Rani Junius**, HoD, Department of Biotechnology,  
Hindustan College of arts & science, Chennai

#### **Internal members**

1. Dr. Wilson Aruni – Pro Vice Chancellor, Sathyabama Institute of Science and Technology
2. Dr. Jemmy Christy – Assistant Professor, Department of Bioinformatics Sathyabama Institute of Science & Technology
3. Dr. Swetha Sunkar - Assistant Professor, Department of Bioinformatics Sathyabama Institute of Science & Technology
4. Dr. Daniel Alex Anand, Associate Professor, Department of Bioinformatics Sathyabama Institute of Science & Technology
5. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department

The BOS meeting has been conducted on **26/06/2020** (online mode) to review the syllabus for the Faculty of Bio & Chemical Engineering to be implemented from the Academic year 2019-20.

1. The Chairman Dr. **Wilson Aruni** greeted and welcomed all members of Board of Studies. The HoDs of Dept. of Biomedical Engg, Biotechnology, Bioinformatics, and Chemical Engineering.
2. The panel members suggested the lab in the first semester to include Cell Biology and Biochemistry instead of Biochemistry lab in line with the theory paper. Therefore the syllabus for the lab is also revised to include the basic experiments in both cell biology and biochemistry.
3. The board members appreciated the inclusion of certain papers like machine learning, python, R programing as core papers as they are rightly identified as the most important courses in the current scenario.
4. Enclosed the Curriculum for B.Sc and M.Sc Bioinformatics and Datascience

**PROGRAMME: BSC  
BIOINFORMATICS AND DATA SCIENCE  
CURRICULUM**

**Total marks for 1<sup>st</sup> Semester =700**

**Total marks for 2<sup>nd</sup> Semester =700**

| Semester 3                                      |             |             |                                |   |   |   |   |         |     |         |
|-------------------------------------------------|-------------|-------------|--------------------------------|---|---|---|---|---------|-----|---------|
| S.no                                            | Course type | Course code | Course Title                   | L | T | P | C | Marks   |     | Page No |
|                                                 |             |             |                                |   |   |   |   | CA<br>E | ESE |         |
| 1                                               | Theory      | SBIA1301    | Molecular Biology and Genomics | 3 | 0 | 0 | 3 | 50      | 50  | 32      |
| 2                                               | Theory      | SBIA1302    | Evolutionary biology           | 3 | 0 | 0 | 3 | 50      | 50  | 33      |
| 3                                               | Theory      | SBIA1303    | Proteomics and Interactomics   | 3 | 1 | 0 | 4 | 50      | 50  | 35      |
| 4                                               | Theory      | SBIA1304    | Perl For Bioinformatics        | 3 | 0 | 0 | 3 | 50      | 50  | 36      |
| 5                                               | Theory      |             | Elective                       | 3 | 0 | 0 | 3 | 50      | 50  |         |
| 6                                               | Practical   | SBIA2301    | Perl Lab                       | 0 | 0 | 4 | 2 | 50      | 50  | 38      |
| 7                                               | Practical   | SBIA2302    | Molecular biology Lab          | 0 | 0 | 4 | 2 | 50      | 50  | 38      |
| Total credits for 3 <sup>rd</sup> Semester = 20 |             |             |                                |   |   |   |   |         |     |         |
| Total marks for 3 <sup>rd</sup> Semester =700   |             |             |                                |   |   |   |   |         |     |         |

| Semester 4                                      |             |             |                                         |   |   |   |   |         |     |         |
|-------------------------------------------------|-------------|-------------|-----------------------------------------|---|---|---|---|---------|-----|---------|
| S.no                                            | Course type | Course code | Course Title                            | L | T | P | C | Marks   |     | Page No |
|                                                 |             |             |                                         |   |   |   |   | CA<br>E | ESE |         |
| 1                                               | Theory      | SCSA1102    | Fundamentals of Python Programing       | 3 | 0 | 0 | 3 | 50      | 50  | 40      |
| 2                                               | Theory      | SCSA1301    | Database management system              | 3 | 0 | 0 | 3 | 50      | 50  | 41      |
| 3                                               | Theory      | SBIA1401    | Structural biology                      | 3 | 1 | 0 | 4 | 50      | 50  | 42      |
| 4                                               | Theory      | SBIA1402    | Immunology and Immunoinformatics        | 3 | 0 | 0 | 3 | 50      | 50  | 43      |
| 5                                               | Theory      |             | Elective                                | 3 | 0 | 0 | 3 | 50      | 50  |         |
| 6                                               | Practical   | SCSA2102    | Fundamentals of python programming lab  | 0 | 0 | 4 | 2 | 50      | 50  | 44      |
| 7                                               | Practical   | SBIA2401    | Sequence analysis lab--II               | 0 | 0 | 4 | 2 | 50      | 50  | 44      |
| 8                                               | PT          | S738APT     | Internship / Skill Development Training | 0 | 0 | 2 | 1 |         | 100 |         |
| Total credits for 4 <sup>th</sup> Semester = 21 |             |             |                                         |   |   |   |   |         |     |         |
| Total marks for 4 <sup>th</sup> Semester =700   |             |             |                                         |   |   |   |   |         |     |         |

| Semester 5                                            |             |             |                                     |   |   |   |   |       |     |         |
|-------------------------------------------------------|-------------|-------------|-------------------------------------|---|---|---|---|-------|-----|---------|
| S.no                                                  | Course type | Course code | Course Title                        | L | T | P | C | Marks |     | Page No |
|                                                       |             |             |                                     |   |   |   |   | CAE   | ESE |         |
| 1                                                     | Theory      | SBIA1501    | Modelling of molecules              | 3 | 0 | 0 | 3 | 50    | 50  | 46      |
| 2                                                     | Theory      | SBIA1502    | Drug design and development         | 3 | 0 | 0 | 3 | 50    | 50  | 47      |
| 3                                                     | Theory      | SBIA1503    | Systems Biology                     | 3 | 0 | 0 | 3 | 50    | 50  | 48      |
| 4                                                     | Theory      | SBIA1504    | Cheminformatics                     | 3 | 0 | 0 | 3 | 50    | 50  | 50      |
| 5                                                     | Theory      |             | Elective                            | 3 | 0 | 0 | 3 | 50    | 50  |         |
| 6                                                     | Practical   | SBIA2501    | Systems biology lab                 | 0 | 0 | 4 | 2 | 50    | 50  | 51      |
| 7                                                     | Practical   | SBIA2502    | Cheminformatics and Drug design Lab | 0 | 0 | 4 | 2 | 50    | 50  | 51      |
| 8                                                     | Seminar     | S738ASEM    | Seminar                             | 0 | 0 | 0 | 1 |       | 100 |         |
| <b>Total credits for 5<sup>th</sup> Semester = 20</b> |             |             |                                     |   |   |   |   |       |     |         |
| <b>Total marks for 5<sup>th</sup> Semester =800</b>   |             |             |                                     |   |   |   |   |       |     |         |

| Semester 6                                            |             |             |                                  |   |   |   |    |       |     |         |
|-------------------------------------------------------|-------------|-------------|----------------------------------|---|---|---|----|-------|-----|---------|
| S.no                                                  | Course type | Course code | Course Title                     | L | T | P | C  | Marks |     | Page No |
|                                                       |             |             |                                  |   |   |   |    | CAE   | ESE |         |
| 1                                                     | Theory      | SBIA1601    | Data mining and Machine Learning | 3 | 0 | 0 | 3  | 50    | 50  | 53      |
| 2                                                     | Theory      | SBIA1602    | Microarray data analysis         | 3 | 0 | 0 | 3  | 50    | 50  | 55      |
| 3                                                     | Practical   | S738APROJ   | Project                          |   |   |   | 15 |       | 100 |         |
| <b>Total credits for 6<sup>th</sup> Semester = 21</b> |             |             |                                  |   |   |   |    |       |     |         |
| <b>Total marks for 6<sup>th</sup> Semester =300</b>   |             |             |                                  |   |   |   |    |       |     |         |

| Semester             | Theory courses (including elective courses) |               |             | Practical Courses (including PT and project) |               |             |
|----------------------|---------------------------------------------|---------------|-------------|----------------------------------------------|---------------|-------------|
|                      | Total no.                                   | Total Credits | Total Marks | Total no.                                    | Total Credits | Total Marks |
| 1                    | 5                                           | 15            | 500         | 2                                            | 4             | 200         |
| 2                    | 5                                           | 15            | 500         | 2                                            | 4             | 200         |
| 3                    | 5                                           | 16            | 500         | 2                                            | 4             | 200         |
| 4                    | 5                                           | 16            | 500         | 2                                            | 5             | 200         |
| 5                    | 5                                           | 15            | 500         | 3                                            | 5             | 300         |
| 6                    | 2                                           | 6             | 200         | 1                                            | 15            | 100         |
| <b>Overall Total</b> | 27                                          | 83            | 2700        | 10                                           | 37            | 1200        |

|                                                  |             |
|--------------------------------------------------|-------------|
| <b>Overall total credits for B.Sc. programme</b> | <b>120</b>  |
| <b>Overall total marks for B.Sc. programme</b>   | <b>4000</b> |

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS  
CAE – CONTINUOUS ASSESSMENT EXAMINATION, ESE – END SEMESTER EXAMINATION,  
VIVA – VIVA VOCE



| SEMESTER-2                                      |             |             |                                                     |   |   |   |   |       |     |          |
|-------------------------------------------------|-------------|-------------|-----------------------------------------------------|---|---|---|---|-------|-----|----------|
| S. NO.                                          | COURSE TYPE | COURSE CODE | COURSE TITLE                                        | L | T | P | C | MARKS |     | PAGE NO. |
|                                                 |             |             |                                                     |   |   |   |   | CAE   | ESE |          |
| 1                                               | Theory      | SCSA5102    | Database Technologies                               | 3 | 0 | 0 | 3 | 50    | 50  | 15       |
| 2                                               | Theory      | SBIA5202    | Immunoinformatics and Computational Vaccinology     | 3 | 0 | 0 | 3 | 50    | 50  | 17       |
| 3                                               | Theory      | SBIA5203    | Biomolecular Modelling                              | 3 | 0 | 0 | 3 | 50    | 50  | 18       |
| 4                                               | Theory      | SBIA5204    | Omics in Biology                                    | 3 | 0 | 0 | 3 | 50    | 50  | 19       |
| 5                                               | Practical   | SBIA6201    | Oracle and SQL Lab                                  | 0 | 0 | 4 | 2 | 50    | 50  | 20       |
| 6                                               | Practical   | SBIA6202    | Immunoinformatics and Computational Vaccinology Lab | 0 | 0 | 4 | 2 | 50    | 50  | 20       |
| 7                                               | PT          | S739APT     | Professional Training                               | 0 | 0 | 0 | 2 | 100   |     |          |
| Total Credits for 2 <sup>nd</sup> semester = 18 |             |             |                                                     |   |   |   |   |       |     |          |
| Total Marks for 2 <sup>nd</sup> semester = 700  |             |             |                                                     |   |   |   |   |       |     |          |

| SEMESTER-3                                      |             |             |                                     |   |   |   |   |       |     |          |
|-------------------------------------------------|-------------|-------------|-------------------------------------|---|---|---|---|-------|-----|----------|
| S. No.                                          | COURSE TYPE | COURSE CODE | COURSE TITLE                        | L | T | P | C | MARKS |     | PAGE NO. |
|                                                 |             |             |                                     |   |   |   |   | CAE   | ESE |          |
| 1                                               | Theory      | SBIA5301    | Systems Biology                     | 3 | 0 | 0 | 3 | 50    | 50  | 22       |
| 2                                               | Theory      | SBIA5302    | Computer Aided drug designing       | 3 | 0 | 0 | 3 | 50    | 50  | 23       |
| 3                                               | Theory      | SBIA5303    | Machine Learning for Bioinformatics | 3 | 0 | 0 | 3 | 50    | 50  | 24       |
| 4                                               | Theory      | SBIA5304    | Microarray data analysis            | 3 | 0 | 0 | 3 | 50    | 50  | 25       |
| 5                                               | Practical   | SBIA6301    | Computer aided drug design Lab      | 0 | 0 | 4 | 2 | 50    | 50  | 27       |
| 6                                               | Practical   | SBIA6302    | Systems Biology Lab                 | 0 | 0 | 4 | 2 | 50    | 50  | 27       |
| Total Credits for 2 <sup>nd</sup> semester = 16 |             |             |                                     |   |   |   |   |       |     |          |
| Total Marks for 2 <sup>nd</sup> semester = 600  |             |             |                                     |   |   |   |   |       |     |          |

| SEMESTER-4                                      |             |             |                        |   |   |   |   |       |     |          |
|-------------------------------------------------|-------------|-------------|------------------------|---|---|---|---|-------|-----|----------|
| Sl. No.                                         | COURSE TYPE | COURSE CODE | COURSE TITLE           | L | T | P | C | MARKS |     | PAGE NO. |
|                                                 |             |             |                        |   |   |   |   | CAE   | ESE |          |
| 1                                               | Theory      | SBIA5401    | R Programming          | 3 | 0 | 0 | 3 | 50    | 50  | 29       |
| 2                                               | Theory      |             | Elective 1             | 3 | 0 | 0 | 3 | 50    | 50  |          |
| 3                                               | Theory      |             | Elective 2             | 3 | 0 | 0 | 3 | 50    | 50  |          |
| 4                                               | Practical   | SBIA6401    | R Programming Lab      | 3 | 0 | 0 | 2 | 50    | 50  | 30       |
| 5                                               | Project     | S739APROJ   | Project Phase I and II | 0 | 0 | 0 | 9 | 100   |     |          |
| Total Credits for 2 <sup>nd</sup> semester = 20 |             |             |                        |   |   |   |   |       |     |          |
| Total Marks for 2 <sup>nd</sup> semester = 500  |             |             |                        |   |   |   |   |       |     |          |

| SEMESTER             | THEORY COURSES (INCLUDING ELECTIVE COURSES) |               |             | PRACTICAL COURSES (INCLUDING PT AND PROJECT) |               |             |
|----------------------|---------------------------------------------|---------------|-------------|----------------------------------------------|---------------|-------------|
|                      | TOTAL NO.                                   | TOTAL CREDITS | TOTAL MARKS | TOTAL NO.                                    | TOTAL CREDITS | TOTAL MARKS |
| 1                    | 4                                           | 12            | 400         | 2                                            | 4             | 200         |
| 2                    | 4                                           | 12            | 400         | 3                                            | 6             | 300         |
| 3                    | 4                                           | 12            | 400         | 2                                            | 4             | 200         |
| 4                    | 3                                           | 09            | 300         | 2                                            | 11            | 200         |
| <b>Overall Total</b> | 15                                          | 45            | 1500        | 9                                            | 25            | 900         |

**LIST OF**

Overall total credits for B.Sc. programme

70

Overall total marks for B.Sc. programme

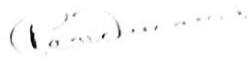
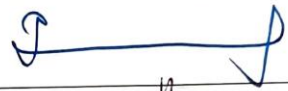
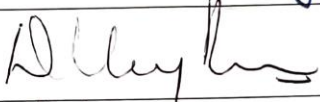
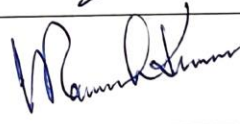
2400

### PROFESSIONAL CORE ELECTIVES

| DEPARTMENT ELECTIVES |             |                                                  |   |   |   |   |       |     |          |
|----------------------|-------------|--------------------------------------------------|---|---|---|---|-------|-----|----------|
| SL. NO.              | COURSE CODE | COURSE TITLE                                     | L | T | P | C | MARKS |     | PAGE NO. |
|                      |             |                                                  |   |   |   |   | CAE   | ESE |          |
| 1                    | SBIA7401    | Cell and Molecular Genetics                      | 3 | 0 | 0 | 3 | 50    | 50  | 31       |
| 2                    | SBIA7402    | Phylogenetic analysis                            | 3 | 0 | 0 | 3 | 50    | 50  | 32       |
| 3                    | SBIA7403    | Cheminformatics                                  | 3 | 0 | 0 | 3 | 50    | 50  | 34       |
| 4                    | SBIA7404    | Pharmacoinformatics                              | 3 | 0 | 0 | 3 | 50    | 50  | 35       |
| 5                    | SBIA7405    | Structural Biology                               | 3 | 0 | 0 | 3 | 50    | 50  | 36       |
| 6                    | SBIA7406    | Data mining in bioinformatics                    | 3 | 0 | 0 | 3 | 50    | 50  | 38       |
| 7                    | SBIA7407    | Medicinal chemistry                              | 3 | 0 | 0 | 3 | 50    | 50  | 39       |
| 8                    | SBIA7408    | Next generation sequence data analysis           | 3 | 0 | 0 | 3 | 50    | 50  | 40       |
| 9                    | SBIA7409    | Health Informatics                               | 3 | 0 | 0 | 3 | 50    | 50  | 41       |
| 10                   | SBIA7412    | Nanotechnology and Advanced Drug Delivery System | 3 | 0 | 0 | 3 | 50    | 50  | 43       |
| 11                   | SCSA7023    | Cloud Computing                                  | 3 | 0 | 0 | 3 | 50    | 50  | 44       |
| 12                   | SCSA7014    | Mathematical Foundations for Computer Science    | 3 | 0 | 0 | 3 | 50    | 50  | 46       |

## Minutes approveds

### Signature of the Members

| Name                                                                                        | Signature                                                                            |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Dr. C Elizabeth Rani Junius                                                                 |    |
| Dr. Wilson Aruni,<br>Pro Vicechancellor,<br>Sathyabama Institute of Science<br>& Technology |    |
| Dr. Jemmy Christy, Assistant<br>Professor                                                   |    |
| Dr.D.AlexAnand, Assistant<br>Professor                                                      |   |
| Dr.Balasankar, Assistant<br>Professor                                                       |  |
| Dr.SwethaSunkar, Assistant<br>Professor                                                     |   |
| Dr. Ramesh Kumar, Associate<br>Professor and head,<br>Biotechnology Department              |  |



# **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY**

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**[www.sathyabama.ac.in](http://www.sathyabama.ac.in)**

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**SCHOOL OF BIO AND CHEMICAL ENGINEERING**

**DEPARTMENT OF BIOINFORMATICS**

**BOARD OF STUDIES - MINUTES OF MEETING**

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Molecular Modelling Lab

**Date:** 27/11/2020

**Agenda:** Opinion/suggestion for improvement of syllabus

**External member**

**Dr. C Elizabeth Rani Junius**, HoD, Department of Biotechnology,  
Hindustan College of arts & science, Chennai

**Internal members**

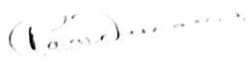
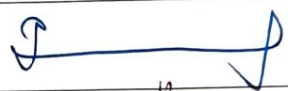
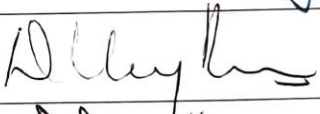
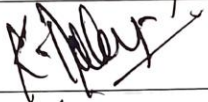
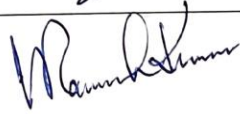
1. Dr. Wilson Aruni – Pro Vice Chancellor, Sathyabama Institute of Science and Technology
2. Dr. Jemmy Christy – Assistant Professor, Department of Bioinformatics Sathyabama Institute of Science & Technology
3. Dr. Swetha Sunkar - Assistant Professor, Department of Bioinformatics Sathyabama Institute of Science & Technology
4. Dr. Daniel Alex Anand, Associate Professor, Department of Bioinformatics Sathyabama Institute of Science & Technology
5. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department

The BOS meeting has been conducted on 27/11/2020 (online mode) to review the syllabus for the Faculty of Bio & Chemical Engineering to be implemented from the Academic year 2019-20 and to make minor amendments.

1. The Chairman Dr. **Wilson Aruni** greeted and welcomed all members of Board of Studies. The HoDs of Dept. of Biomedical Engg, Biotechnology, Bioinformatics, and Chemical Engineering.
2. One of the first suggestions made was to include a more modules in the laboratory course SBIA2201 and SBIA2401 Sequence analysis labs I and II.
3. The modules Conserved Domain Search Service, Genome Workbench, Primer-BLAST and ProSplign were suggested to be included in the lab I
4. Whole genome analysis tools such as Phred, COV2HTML, GenSAS, BAGEL and VIOLIN were suggested to be added to the lab II.

### Minutes approved

#### Signature of the Members

| Name                                                                                        | Signature                                                                            |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Dr. C Elizabeth Rani Junius                                                                 |  |
| Dr. Wilson Aruni,<br>Pro Vicechancellor,<br>Sathyabama Institute of Science<br>& Technology |  |
| Dr. Jemmy Christy, Assistant<br>Professor                                                   |  |
| Dr.D.AlexAnand, Assistant<br>Professor                                                      |  |
| Dr.Balasankar, Assistant<br>Professor                                                       |  |
| Dr.SwethaSunkar, Assistant<br>Professor                                                     |   |
| Dr. Ramesh Kumar, Associate<br>Professor and head,<br>Biotechnology Department              |  |



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**SCHOOL OF BIO AND CHEMICAL ENGINEERING**

**DEPARTMENT OF BIOINFORMATICS**

**BOARD OF STUDIES - MINUTES OF MEETING**

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Molecular Modelling Lab

**Date:** 03/07/2021

**Agenda:** Opinion/suggestion for improvement of syllabus

**The following members were present**

Chairperson

**Dr. Wilson Aruni**, Pro-VC, Sathyabama Institute of Science and Technology

External Member

1. **Dr. C Elizabeth Rani Junius**, HoD, Department of Biotechnology,  
Hindustan College of arts & science, Chennai

Department Members

1. Dr. Jemmy Christy, Assistant Professor
2. Dr. D. Alex Anand, Assistant Professor
3. Dr. Swetha Sunkar, Assistant Professor

Internal members

1. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department
2. Dr. Valli Nachiyar, Associate Professor, Biotechnology Department.
3. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.

A Meeting of the Board of Studies for the Department of Bioinformatics with external member was held on 03-07-21 at 11.00 a.m. virtually to discuss about the content revision for The following two papers of B.Sc Bioinformatics and Data science and one paper for M.Sc Bioinformatics and Data science have been put forth for revision

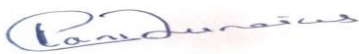
### Minutes of the BOS meeting

- The Chairperson Dr. Wilson Aruni, Pro Vice-chancellor welcomed the External and Internal members for the Board of Studies meeting held on 3<sup>rd</sup> July 2021 at 11 AM.
- The theory paper modeling of molecules, Next generation sequencing, Structural and Functional genomics has been modified and put forth for BOS approval.
- A copy of the syllabi framed by the Internal BOS members was sent a week in advance to the External Member according to their specialization and field of expertise for their review. Their valuable suggestions and comments were received well before the meeting and modifications have been carried out and kept before the members today for further discussions.
- The revisions have been carried out in such a way that a make it more coherent for the current application
- Revised curriculum was discussed and approved.

Meeting ended with vote of thanks.

### Minutes approved.

Members:

|                               |                                                                                      |
|-------------------------------|--------------------------------------------------------------------------------------|
| Dr. Wilson Aruni              |   |
| Dr. C. Elizabeth Rani Juneius |   |
| Dr. Alex Anand                |   |
| Dr. Jemmy Christy             |  |

|                   |                                                                                   |
|-------------------|-----------------------------------------------------------------------------------|
| Dr. Swetha Sunkar |  |
|-------------------|-----------------------------------------------------------------------------------|



# SATHYABAMA

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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOINFORMATICS

BOARD OF STUDIES - MINUTES OF MEETING

**Subject:** Board of Studies- Department of Bioinformatics

**Venue:** Molecular Modelling Lab

**Date:** 29/11/2021

**Agenda:** Opinion/suggestion for improvement of syllabus

**The following members were present**

Chairperson

1. Dr. Wilson Aruni, Pro-VC, Sathyabama Institute of Science and Technology

External Member

2. Dr. C Elizabeth Rani Junius, HoD, Department of Biotechnology,  
Hindustan College of arts & science, Chennai

Department Members

4. Dr. Jemmy Christy, Assistant Professor
5. Dr. D. Alex Anand, Assistant Professor
6. Dr. Swetha Sunkar, Assistant Professor

Internal members

4. Dr. Ramesh Kumar, Associate Professor and head, Biotechnology Department
5. Dr. Valli Nachiyar, Associate Professor, Biotechnology Department.
6. Dr. Jayshree Nellore, Associate Professor, Biotechnology Department.

A Meeting of the Board of Studies for the Department of Bioinformatics with external member was held on 29/11/2021 at 11.00 a.m. virtually to discuss about the content revision for The following two papers of B. Sc Bioinformatics and Data science and one paper for M.Sc Bioinformatics and Data science have been put forth for revision

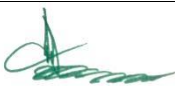
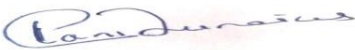
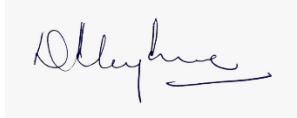
## Minutes of the BOS meeting

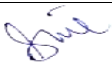
- The Chairperson Dr. Wilson Aruni, Pro Vice-chancellor welcomed the External and Internal members for the Board of Studies meeting held on 29/11/2021 at 11 AM.
- In the theory paper SBIA1401, Structural Biology for the BSc course the last unit is devoid of tools for research. This was proposed to be included. The proposed tools were COOT and MAIN for model building and Dino, CueMol, ENDscript, ESPrip and GRASP for molecular graphics.
- In the PG curriculum of SBIA7409, Health informatics, updated databases such as access medicine, clinical key, embase and trip database were suggested to be included in the final unit.
- The revisions have been carried out in such a way that a make it more coherent for the current application
- Revised curriculum was discussed and approved.

Meeting ended with vote of thanks.

## Minutes approved.

Members:

|                                  |                                                                                     |
|----------------------------------|-------------------------------------------------------------------------------------|
| Dr. Wilson Aruni                 |  |
| Dr. C. Elizabeth Rani<br>Juneius |  |
| Dr. Alex Anand                   |  |
| Dr. Jemmy Christy                |  |

|                   |                                                                                   |
|-------------------|-----------------------------------------------------------------------------------|
| Dr. Swetha Sunkar |  |
|-------------------|-----------------------------------------------------------------------------------|

**Department of Bioinformatics**  
**BOS – July 3<sup>rd</sup> 2021**  
**Syllabus revision**

The following two papers of B. Sc Bioinformatics and Datascience and two papers for M. Sc Bioinformatics and Datascience have been put forth for revision.

List of Papers for which revisions are suggested

| <b>B. Sc (Bioinformatics and Datascience)</b> |              |                                                   |
|-----------------------------------------------|--------------|---------------------------------------------------|
| S.No                                          | Subject Code | Subject name                                      |
| 1                                             | SBIA1501     | Modelling Of Molecules (Semester 5)               |
| 2                                             | SBIA3004     | Next Generation Sequencing (Elective)             |
| <b>M.Sc (Bioinformatics and Data science)</b> |              |                                                   |
| 3                                             | SBIA5101     | Structural And Functional Genomics (Semester 1)   |
| 4                                             | SBIA7408     | Next Generation Sequence Data Analysis (Elective) |

## 2019 regulation Syllabus

| SBIA1501 | MODELLING OF MOLECULES | L | T | P | Credits | Total Marks |
|----------|------------------------|---|---|---|---------|-------------|
|          |                        | 3 | 1 | 0 | 4       | 100         |

### COURSE OBJECTIVES

The course intends to impart knowledge on the various concepts of molecular modelling and its application in drug designing with a focus on identification of lead molecules and the concept of pharmacophore.

#### Unit I INTRODUCTION TO QUANTUM MECHANICS

9hrs

Basic Concepts in Molecular Modelling: Introduction, Coordinate systems, Energy surfaces. Introduction to Quantum mechanics - Schrodinger wave equation, Time dependent and time independent forms.

#### Unit II BASICS OF MOLECULAR MECHANICS

9hrs

Features of molecular mechanics, force fields; Bond structure and bending angles – electrostatic, van der Waals and non –bonded interactions, hydrogen bonding; Energy minimization; Application of energy minimization.

#### Unit III MOLECULAR MECHANICS

9hrs

Molecular Mechanics Introduction, Vander Waals and Dipole-Dipole Interaction, Types of Potential- Lennard- Jones, Truncated Lennard – Jones, Ionic and Polar potentials, Types of force field- AMBER, CHARMM, Merck Molecular Force Field, Consistent Force Field, MM2, MM3 and MM4 Force Field.

#### Unit IV MOLECULAR DYNAMICS

9hrs

Molecular Dynamics using simple models; Molecular Dynamics with continuous potentials and at constant temperature and pressure; Time-dependent properties; Solvent effects in Molecular Dynamics; Conformational changes from Molecular Dynamics simulation. Introduction, Newton's equation of motion, equilibrium point, radial distribution function, pair correlation functions, MD methodology, periodic box, algorithm for time dependence; leapfrog algorithm, Verlet algorithm, Boltzman velocity, time steps, duration of the MD run.

#### Unit V SIMULATION AND MODELLING

9hrs

Methods of computer aided drug design, ligand design methods, drug design approaches, Target identification and validation, lead optimization and validation, Structure and ligand-based drug design, modelling of target-small molecule interactions.

### COURSE OUTCOMES

At the end of the course the students will

**CO1** –Be able to apply and understand the modelling on the basis of quantum mechanical aspects.

**CO2** –To discuss the various types of interactions possible between the macromolecule and the ligand.

**CO3** –Identify the lead molecule by virtual screening.

**CO4** –Design the strategy towards drug design.

**CO5** –Design the strategy towards drug design based on the structural aspects of the macromolecule.

**CO6** –Adopt and implement the concepts of modelling to derive structures for molecules

**TEXT / REFERENCE BOOKS:**

1. Andrew Leach - Molecular Modelling: Principles and Applications, 2nd Edition. Pearson Education EMA, 2001.
2. R.K. Prasad - Quantum Chemistry, 3rd Edition, 2006.

## Syllabus after revision

| SBIA1501 | MODELLING OF MOLECULES | L | T | P | Credits | Total Marks |
|----------|------------------------|---|---|---|---------|-------------|
|          |                        | 3 | 1 | 0 | 4       | 100         |

### COURSE OBJECTIVES

The course intends to impart knowledge on the various concepts of molecular modelling and its application in drug designing with a focus on identification of lead molecules and the concept of pharmacophore.

### Unit I Introduction to quantum mechanics

Basic Concepts in Molecular Modelling: Introduction, Coordinate systems, Energy surfaces. Introduction to Quantum mechanics - Schrodinger wave equation, Time dependent and time independent forms. Born-Oppenheimer approximation

### Unit II Molecular mechanics

Features of molecular mechanics, force fields; Bond structure and bending angles – electrostatic, van der Waals and non –bonded interactions, hydrogen bonding; Commonly used forcefields – AMBER, CHARMM, GROMOS. Energy minimization – Potential energy surface, algorithms. Application of energy minimization.

### Unit III Conformational analysis and simulation

Conformational analysis – introduction, conformational search methods. Computer Simulation: Basics, Uses. Molecular dynamics simulation – Time and ensemble averages, analysis of MD simulations. Monte Carlo simulation method.

### Unit IV Biological Thermodynamics

Basics of thermodynamics: entropy, enthalpy, Gibbs free energy. Energy transformation in biological systems, Laws of thermodynamics. Boltzmann rule. Thermodynamic models of binding.

### Unit V Applications of molecular modelling

Molecular modelling in drug design - CADD, Docking and QSAR studies, Protein 3D modelling. Modeling interactions, Organic–Inorganic Interface Simulations for Smart Novel Material Discoveries, Modeling of Nanopores for DNA Sequencing Applications

Color ash represents the syllabus to be changed; Color orange represents the changed content

**Justification**

- The theory paper SBIA1501 - Modeling of molecules has been modified and put forth for BOS approval. The changes carried out are
- Unit 3 4 and 5 have been changed to encompass all the important concepts in modelling.
- Conformational analysis which was initially not included is included in unit 3 and simulation concepts provided in unit 4 has been included in unit 3.
- The concept of thermodynamics is included in unit 4 as this is the basis for the functioning and stability of a system.
- Unit 5 is modified to include the applications of molecular modelling from drug design to novel material discovery and also nanopore modelling as this would give an insight into the latest research utility of molecular modelling

## 2019 regulations - syllabus

| SBIA3004 | NEXT GENERATION SEQUENCING | L | T | P | Credits | Total Marks |
|----------|----------------------------|---|---|---|---------|-------------|
|          |                            | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVES

This course will provide an introduction to the technology, data analysis, tools and resources for next generation sequencing data. The content is intended to provide a broad overview of the subject areas, and to highlight key resources, approaches and methodologies.

#### Unit I INTRODUCTION TO NGS

9hrs

NGS Platforms: Introduction to NGS, Roche/454 FLX, Illumina/Solexa Genome Analyzer, Applied Biosystems SOLiD system, Helicos Heliscope, Pacific Biosciences/single molecule real time (SMRT) sequencing.

#### Unit II SEQUENCE DATA

9hrs

Genome assembly algorithms: Alignment of short-reads to reference genome using spaced seed (ELAND, SOAP), index-filtering algorithm (SeqMap), quality-score (RMAP), q-filter algorithm (SHRiMP), FM-index (Bowtie, BWA, SOAP2), suffix tree (MUMmer). Sequence Alignment formats: Sequence Alignment/Map (SAM) format, Binary Alignment/Map (BAM) format, Tools for conversion (SAMtools), Alignment viewers (IGV, MGAviwer).

#### Unit III SEQUENCE DATA ASSEMBLY

9hrs

De-novo assembly: Overlap-layout-consensus (OLC) approach (Arachne, Phusion), de Bruijn and Euler path approach (Euler, SOAPdenovo), string graph assembler (SGA). Scaffolding: Supercontig, contig orientation, contig ordering, contig distancing and gap closing using SOAPdenovo, ABySS, OPERA and RACA.

#### Unit IV SOFTWARES IN NGS ANALYSIS

9hrs

Application of R in NGS analysis: Introduction to Bioconductor, Reading of RNA-seq data (ShortRead, Rsamtools, GenomicRanges), annotation (biomaRt, genome Intervals), reads coverage and assign counts (IRanges, Genomic Features), differential expression (DESeq).

#### Unit V APPLICATIONS

9hrs

Biological applications of NGS: Whole-genome sequencing, Exome sequencing, Transcriptome sequencing, Epigenome sequencing, Interactome sequencing, methylome sequencing.

### COURSE OUTCOMES

At the end of the course the students will

**CO1** –Describe the applications of the different NGS technologies, including the weakness and strengths of the approaches.

**CO2** –Explain the steps involved in a general NGS data analysis.

**CO3** –Explain key theoretical concepts of alignment and de novo assembly.

**CO4** –Synthesize and formulate a project and relevant question within the field.

**CO5** –Independently perform a basic NGS data analysis.

**CO6** –Apply analytical and reflective skills in analyzing results from individual steps and the final project.

### TEXT / REFERENCE BOOKS:

1. Next-generation DNA sequencing Informatics by Stuart M. Brown, Cold Spring Harbor Laboratory, 2013.
2. RNA-seq Data Analysis: A Practical Approach by Eija Korpelainen, Jarno Tuimala, Panu Somervuo, Mikael Huss, Garry Wong. Chapman & Hall/CRC, 2014.
3. Next generation sequencing: Translation to Clinical Diagnostics by Wong Lee-Jun C. (ed.), Springer, 2013.
4. Next-generation genome sequencing: Towards Personalized Medicine by Michal Janitz, WileyVCH, 2008

### **Syllabus after revision**

| SBIA3004 | NEXT GENERATION SEQUENCING | L | T | P | Credits | Total Marks |
|----------|----------------------------|---|---|---|---------|-------------|
|          |                            | 3 | 0 | 0 | 3       | 100         |

### **COURSE OBJECTIVES**

This course will provide an introduction to the technology, data analysis, tools and resources for next generation sequencing data. The content is intended to provide a broad overview of the subject areas, and to highlight key resources, approaches and methodologies.

#### **Unit 1 Introduction to sequencing**

Over view of sequencing, Need and applications. Generations in sequencing – first generation sequencing – Sangers method and Maxam Gilbert method. Second generation sequencing – NGS platforms - Roche/454, Illumina/Solexa, Ion torrent, SOLiD system. Third generation sequencing

#### **Unit 2 NGS workflow**

Library preparation – Template enrichment – Emulsion and Bridge PCR, Sequencing: NGS platforms; Comparison of NGS platforms. Data analysis- Data acquisition - Reads and quality check, Base calling. Read alignment and refinement, Sequence assembly. Variant calling. File formats used in NGS.

#### **Unit 3 RNA SEQUENCING**

Data acquisition- Read alignment – Transcriptome assembly - Differential expression analysis – Alternative splicing - Allele-specific expression - RNA editing – smRNA

#### **Unit 4 Chip Seq**

Basics on immune precipitation, Types of Chips Seq – XchIP and NChIP. Workflow – isolation, mapping, peak finding – functional analysis and annotation

#### **Unit 5 Applications of NGS**

Whole-genome sequencing, Exome sequencing, Targeted sequencing, Pooled sequencing, methylome sequencing. Next generation sequencing applications in Agri-Biotech, health care, metagenomics, GWAS.

Color ash represents the syllabus to be changed; Color orange represents the changed content

### **Justification**

- The revisions have been carried out in such a way that a complete overview of NGS and its types have been incorporated.
- Introduction to the need of sequencing has been added in unit 1 to refresh the basics of sequencing.
- Unit 2 has been reframed in such a way that it includes the entire process of NGS
- RNA seq has been included in Unit 3 as working on transcriptome is focused currently
- Chip seq has been included in unit 4 as this topic deals with the overall interactions between proteins and DNA.
- Unit 5 has been retained as that includes the different applications of NGS in various fields of research

| SBIA5101 | STRUCTURAL AND FUNCTIONAL GENOMICS | L | T | P | Credits | Total Marks |
|----------|------------------------------------|---|---|---|---------|-------------|
|          |                                    | 3 | * | 0 | 3       | 100         |

### **COURSE OBJECTIVES**

To have a knowledge on the conformational parameters and their influence on the structure of the macromolecule and to acquire a knowledge on the structure and activity relationship.

### **UNIT I INTRODUCTION**

Structure & Organization of Prokaryotic & Eukaryotic genome - Nucleotide and protein sequencing methods –Chemical, Enzymatic, high through put method – Automated sequencing methods – shotgun – chromosome walking, Contig assembly - Levels of structures in biological macromolecules.

### **UNIT II CONFORMATIONAL ANALYSIS**

Biomolecules and their interactions - Forces that determine protein and nucleic acid structure, basic problems, polypeptide chains geometrics, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and ionic interactions, disulphide bonds - Prediction of proteins structure - Nucleic acids, general characteristics of nucleic acid structure, geometrics, glycosidic bond rotational isomers - Ribose puckering - forces stabilizing ordered forms, base pairing, base stacking- tertiary structure of nucleic acids.

### **UNIT III STRUCTURAL ANALYSIS OF MACROMOLECULES**

Size and shape of macromolecules - methods of direct visualization - X-ray crystallography – X-ray diffraction, determination of molecular structures, electron microscopy, NMR. Protein structure databases - Protein Data Bank - SCOP - CATH - structure superposition - RMSD - TM-score- structure alignment - Different structure alignment algorithms - DALI, CE, VAST, TM-align - protein folds in PDB.

### **UNIT IV STRUCTURE-FUNCTIONS RELATIONSHIP**

DNA binding proteins, Prokaryotic and Eukaryotic transcription factors - DNA polymerases, Helix-turn-Helix motif in DNA binding, Trp repressor, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers - DNA polymerases, Membrane proteins and receptors, Transmembrane segments, bacterio-rhodopsin, photosynthetic centers, epidermal growth factor, insulin and PGDGF receptors and their interaction with effectors, protein phosphorylation, immunoglobulins, Serine proteases, ribonuclease, lysozyme.

### **UNIT V FUNCTIONAL GENOMICS**

Introduction to Functional Genomics - cytological maps - Hap Map - SNPs and variation- Genotyping, microarray- analysis and applications. Microarray oligo sets and fabrication - integrative genomics and Meta genomics. Quantitative Proteomics. Fluorescent imaging techniques. Quantitative RT-PCR analysis. High-throughput cloning and expression strategies. Next Generation Sequencing applications.

### **COURSE OUTCOMES**

On completion of the course the student will be able to

**CO1:** The student will acquire a basic knowledge on the basics of genomics.

**CO2:** They will be able to appreciate the influence of conformational parameters on the structure of the macromolecule.

**CO3:** Will be able to select the particular method of structural analysis methodology, given the protein.

**CO4:** Assess the structure and activity relationship of the macromolecule.

**CO5:** Acquire knowledge on the functional aspects of genomics.

**CO6:** Explore the strategies used in high throughput screening of biological data

#### **TEXT / REFERENCE BOOKS**

1. Cantor R., Schimmel P.R., Biophysical Chemistry, Vol. I, II, W.H. Freeman & Co., 1985.
2. Kensal E. van Holde, W. Curtis Johnson and P. Shing Ho, Principle of Physical Biochemistry, Prentice Hall, New York, 1998.
3. Pennington SR, Dunn MJ, Proteomics from Protein Sequence to Function, Viva Books Ltd, 2002.
4. G. Gibson and M. V. Muse. A primer of Genome Science. Sinauer Associates Inc; 2 edition, December 2004.

## **Syllabus after revision**

| SBIA5101 | STRUCTURAL AND FUNCTIONAL GENOMICS | L | T | P | Credits | Total Marks |
|----------|------------------------------------|---|---|---|---------|-------------|
|          |                                    | 3 | * | 0 | 3       | 100         |

### **COURSE OBJECTIVES**

To have a knowledge on the conformational parameters and their influence on the structure of the macromolecule and to acquire a knowledge on the structure and activity relationship.

### **UNIT I INTRODUCTION**

Structure & Organization of Prokaryotic & Eukaryotic genome - Nucleotide and protein sequencing methods –Chemical, Enzymatic, high through put method – Automated sequencing methods – shotgun –, Contig assembly - Levels of structures in biological macromolecules.

### **UNIT II CONFORMATIONAL ANALYSIS**

Biomolecules and their interactions - Forces that determine protein and nucleic acid structure, hydrogen bonding, hydrophobic interactions and ionic interactions, disulphide bonds. Nucleic acids, general characteristics of nucleic acid structure, geometrics, glycosidic bond rotational isomers - Ribose puckering - forces stabilizing ordered forms, base pairing, base stacking-tertiary structure of nucleic acids.

### **UNIT III STRUCTURAL ANALYSIS OF MACROMOLECULES**

Size and shape of macromolecules - methods of direct visualization - X-ray crystallography – X-ray diffraction, determination of molecular structures, electron microscopy, NMR. Protein structure databases - Protein Data Bank - SCOP - CATH - structure superposition - RMSD - TM-score- structure alignment - Different structure alignment algorithms - DALI, TM-align.

### **UNIT IV STRUCTURE-FUNCTIONS RELATIONSHIP**

DNA binding proteins, Prokaryotic and Eukaryotic transcription factors - DNA polymerases, Helix-turn-Helix motif in DNA binding, Trp repressor, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers - DNA polymerases, Membrane proteins and receptors, Trans-membrane segments, bacterio-rhodopsin, photosynthetic centers, epidermal growth factor, protein phosphorylation, Serine proteases, ribonuclease, lysozyme.

### **UNIT V FUNCTIONAL GENOMICS**

Introduction to Functional Genomics - cytological maps - Hap Map - SNPs and variation-Genotyping, microarray- analysis and applications. Meta genomics. Quantitative Proteomics. Fluorescent imaging techniques. Quantitative RT-PCR analysis.

Color ash represents the syllabus to be changed; Color orange represents the changed content

### **Justification**

- The following “basic problems, polypeptide chains geometrics, potential energy calculations, observed values for rotation angles,” has been removed from unit 3 as it comes under geometry
- CE, Folds in PDB are removed from unit 3 as it is shown in structure classification databases
- Insulin and PGDGF receptors and their interaction with effectors, immunoglobulins have been removed from unit 4 as there are too many examples.
- Microarray oligo sets and fabrication - integrative genomics and High-throughput cloning and expression strategies. Next Generation Sequencing applications have been removed from unit 5 to justify the title of the unit

## 2019 Regulation syllabus

| SBIA7408 | NEXT GENERATION SEQUENCE<br>DATA ANALYSIS | L | T | P | Credits | Total<br>Marks |
|----------|-------------------------------------------|---|---|---|---------|----------------|
|          |                                           | 3 | 0 | 0 | 3       | 100            |

### COURSE OBJECTIVES

- NGS bioinformatics workflow steps following sequence generation
- NGS for transcriptomics; QC, mapping, visualization tools
- NGS for genomics; assembly, alignment, QC and variant calling tools
- Exploring EMBL-EBI resources

### UNIT I DNA SEQUENCING

9hrs

DNA Sequencing, first generation DNA sequences, Drawbacks of the first-generation sequencing method- Emergence of Next generation sequencing -Platform overview- Biological applications- Basic concepts- Recent scientific breakthroughs using NGS technology

### UNIT II OVERVIEW OF NGS TECHNOLOGY

9hrs

Pyro-sequencing, Illumina Genome Analyzer, Applied Biosystems Sequencing, Ion Torrent Sequencing, Polonator Technology, Nanopore Sequencing, Single Molecule Real Time DNA sequencing- Comparison of Next generation sequencing techniques, & applications- Drawbacks of NGS, NGS File formats- FASTA, FASTQ, FNA, CSFASTA, GFF, SAM and BAM

### UNIT III NGS DATABASES AND ANALYSIS OF NGS DATA

9hrs

NGS databases, Sequence Analysis: Pairwise and multiple sequence alignment methods and tools-Sample data processing with annotation

### UNIT IV ALIGNMENT AND ANALYSIS

9hrs

Genome alignment and analysis tools-BWA (Burrows-Wheeler Aligner), SAMtools, GATK (The Genome Analysis Toolkit), IGV (Integrative Genomics Viewer), HISAT, StringTie, Cuffcompare, Velvet, Oases, Trinity

### UNIT V TRANSCRIPTOMICS ANALYSIS

9hrs

Transcriptome (RNA) sequencing, Exome sequencing, Genome Annotation, Using NGS to detect sequence variants, ChIP-sequence, biological theories on ChIP-sequence analysis, Understanding the non – coding genome, Disease gene identification, DNA fragment evaluation, Peak identification, two condition comparison, Saturation analysis, Motif finding and related theories

Max 45 hrs

### COURSE OUTCOMES

After this course the students will be able to

**CO 1:** Discuss a variety of applications and workflow approaches for NGS technologies

**CO 2:** Use a range of bioinformatics software and tools to undertake basic analysis of NGS data

**CO 3:** Understand the advantages and limitations of NGS analyses

**CO 4:** Submit, browse and access a range of NGS data available in public repositories using EBI resources

**CO 5:** Comprehend the different areas of NGS analysis utility

**CO 6:** Apply the knowledge of NGS technology in transcriptome data analysis

**TEXT BOOKS /REFERENCES**

1. Ali Masoudi-Nejad, Zahra Narimani, Nazanin Hosseinkhan; “Next Generation Sequencing and Sequence Assembly”, Methodologies and Algorithms, Springer; 2013.
2. Stuart M. Brown, “Next-Generation DNA Sequencing Informatics”, Cold Spring Harbor Laboratory Press, 2013.
3. Mark I. Rees, “Challenges and Opportunities of Next-generation Sequencing for Biomedical Research”, Academic Press, 2012.

**2019 Regulation syllabus**

| SBIA7408 | NEXT GENERATION SEQUENCE<br>DATA ANALYSIS | L | T | P | Credits | Total<br>Marks |
|----------|-------------------------------------------|---|---|---|---------|----------------|
|          |                                           | 3 | 0 | 0 | 3       | 100            |

**COURSE OBJECTIVES**

- NGS bioinformatics workflow steps following sequence generation
- NGS for transcriptomics; QC, mapping, visualization tools
- NGS for genomics; assembly, alignment, QC and variant calling tools
- Exploring EMBL-EBI resources

**UNIT I DNA SEQUENCING**

DNA Sequencing, first generation DNA sequencing, Drawbacks of the first-generation sequencing method- Emergence of Next generation sequencing -Platform overview- Biological applications- Basic concepts- Recent scientific breakthroughs using NGS technology

**UNIT II OVERVIEW OF NGS TECHNOLOGY**

Pyro-sequencing, Illumina Genome Analyzer, Applied Biosystems Sequencing, Ion Torrent Sequencing, Polonator Technology, Nanopore Sequencing, Single Molecule Real Time DNA sequencing- Comparison of Next generation sequencing techniques, & applications- Drawbacks of NGS, NGS File formats- FASTA, FASTQ, FNA, CSFASTA, GFF, SAM and BAM

**UNIT III NGS DATABASES AND ANALYSIS OF NGS DATA**

NGS databases. Data analysis work flow: Library preparation, Sequencing, Data analysis: reads, Alignment and assembly, variant calling

**UNIT IV Transcriptome analysis**

Transcriptome (RNA) sequencing, Data acquisition- Read alignment – Transcriptome assembly - Differential expression analysis – Allele-specific expression - RNA editing.

**UNIT V NGS applications**

Exome sequencing, Targeted sequencing, Whole-genome sequencing, Pooled sequencing, methylome sequencing. Role of NGS in Agri-Biotech, health care, metagenomics, GWAS.

Color ash represents the syllabus to be changed; Color orange represents the changed content

**Justification**

- The syllabus of NGS has been reframed to make it more coherent
- Details on NGS workflow has been incorporated in unit 3 to provide more clarity
- Unit 4 focuses on RNA seq which is shifted from unit 5
- Unit 5 includes all the applications of NGS.



