INNOVATIVE TEACHING

M.Tech
Department of Biotechnology
Ramaiah Institute of
Technology Bengaluru-560054

Records of instructional methods used, and pedagogical initiative used in teaching learning

In accordance with the institutional policy of the Ramaiah Institute of technology (RIT), the department of biotechnology has adopted the outcome-based education (OBE) for teaching learning process. The OBE model ensures well defined articulated, and validated learner centric approaches where course outcomes have been developed for every topic they learn and eventually the course outcomes are mapped to Program outcomes (Pos). Innovative teaching methodologies as listed below have been implemented for effective teaching learning process.

1. STUDENT CENTRIC LEARNING
    - ➢ Design of OBE based curriculum
    - ➢ Continuous internal evaluation (CIE)
2. PEDEGOGY FOR INNOVATIVE TEACHING AND LEARNING
    - ➢ Project based learning
    - ➢ Experiential and participative learning
    - ➢ ICT support system for teaching and learning
    - ➢ Reproducibility / reusability & Peer review process

STUDENT CENTRIC LEARNING

DESIGN OF OBE BASED CURRICULUM:

The curriculum of M.Tech in Biotechnology Programme is designed by keeping the needs of stake holders and industry. The present curriculum has been design according to guidelines provide by AICTE and VTU and includes the following major components .

- Programme Core
- Programme Electives
- Internship
- Technical Seminars
- Project Work

Programme Core

These are the major courses of the M.Tech Biotechnology curriculum. These courses expose students to the advanced topics in the foundation courses of the Biotechnology such as Cell and molecular biology, Bioprocess engineering, upstream and downstream processing, Biopharmaceutical technology etc. These courses help students to understand the theoretical foundations to the other elective courses.

Laboratory courses in the curriculum provide the hands on exposure to the concepts studied in the theory courses. These courses provide practical exposure to students to use advanced equipments and equip them to later work in industries and cutting edge research areas.

Programme Elective

Biotechnology is a vast field and has many domains under it. The electives included in the programme curriculum belong to the domain of Food and agricultural biotechnology, Health and medical biotechnology and Bioprocess engineering and environmental biotechnology. Elective courses included in the curriculum provide a deeper knowledge to the students in the domain of interest.

Technical Seminars

Technical seminars play a key role and aid the students to explore recent topics in the field of biotechnology which are beyond the curriculum. Three technical seminars included in the curriculum provide thorough training to the students in effective technical communication and report writing. Seminars also help students to gain confidence to face the audience and also in public speaking.

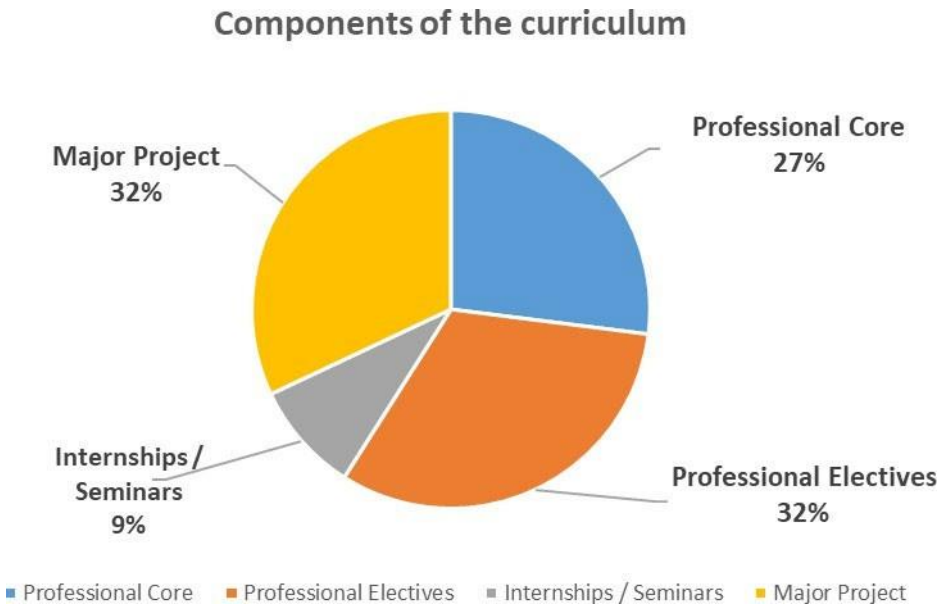
Internship

Internship component provide educational and career development opportunities and also provides practical experience in industry/R&D setups. It is also an excellent educational and career development opportunity in the field of biotechnology. As internship is structured, short-term, supervised activity which is focused around particular tasks or projects with defined timelines, it translates into placements for students. The internship is meaningful and mutually beneficial to the student and the industry.

Project Work

Project Work is a learning experience which aims to provide students with the opportunity to synthesize knowledge from various areas of learning, and critically and creatively apply it to real life situations. The project work allows the candidates to demonstrate an understanding of theory and its application at Masters level. This is the core component of the PG programme.

Project work, seminars, Industrial visits, industry internships provide exposure to the students to the much needed platform for development of real time skills and knowledge, which will make them competent to serve biotechnology industry and research.



Components of the curriculum (sample)

EVALUATION PROCESS (SEE and CIE)

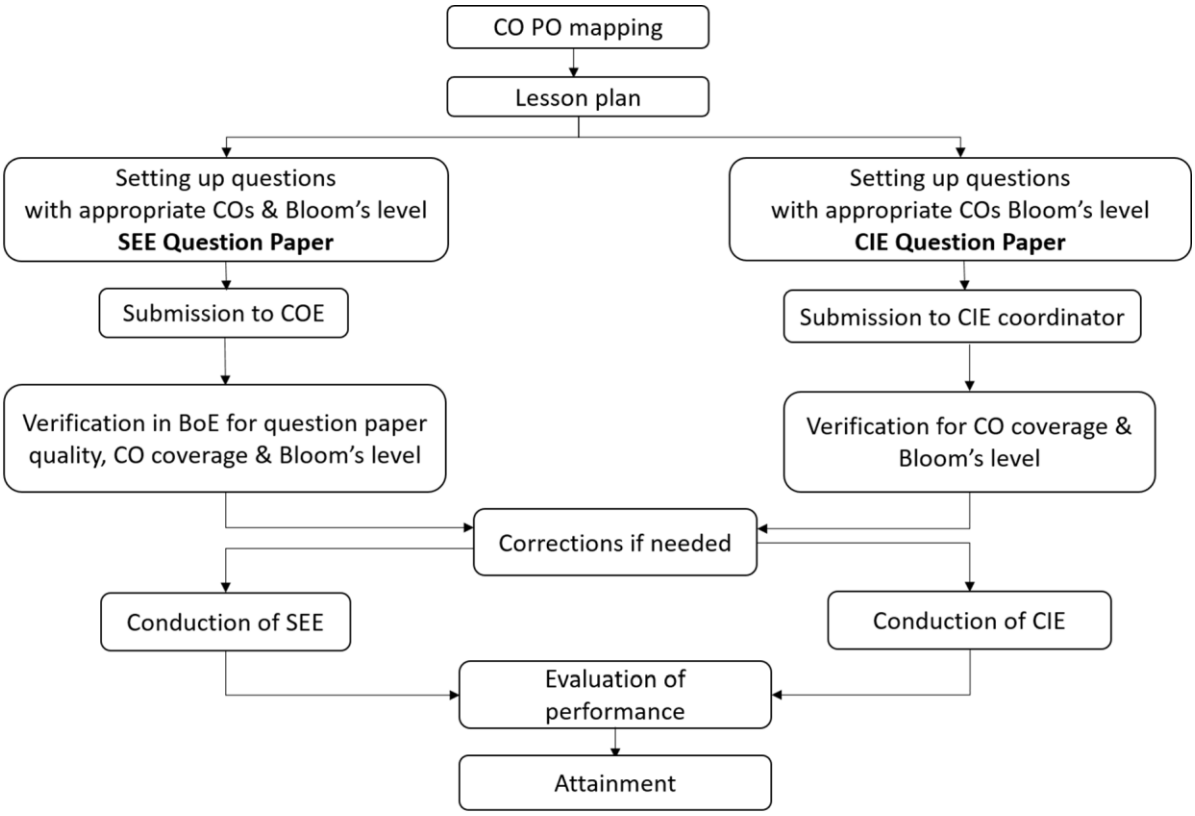
EVALUATION PROCESSES

Quality of end semester examination, internal semester question papers, assignments and evaluation

The assessment structure for each course is based on the Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE) with 50% weightage for each. A student is required to take two internal tests and assignment/quiz/mini-project components in CIE. At the end of the semester, the student has to appear for the SEE and post evaluation, the grades are announced. Quality is inbuilt in the CIE and SEE assessment systems. The CIE and SEE evaluation components have to cover all the Course Outcomes (COs) defined for each course at the beginning of the semester. The CIE and SEE question papers along with the assignment/Mini project/ Quiz etc should satisfy the Bloom's taxonomy action verbs.

Process for end semester examination, internal semester question paper setting and evaluation and effective process implementation

The overall process for end semester examination, internal semester question paper setting and evaluation and effective process implementation is as shown in Fig.



Process for end semester examination, internal semester question paper setting and evaluation and effective process implementation

Details of various committees involved in the effective process implementation of quality of SEE and CIE examinations

Name of the committee	Functions	Working Process	Regulations
Controller of Examinations office (CoE)	Complete responsibility of conduction of examinations	Monitoring the entire examination process from question paper selection, printing, conduction of examination, coordination of evaluation and announcement of results.	The CoE's office works under the regulations stipulated by the institute, from time to time.
Board of Examiners (BoE)	Scrutiny and approval of semester end examination papers.	BoE meets once in a semester to review and approve the question papers along with the scheme and solutions.	The committee consists of HOD as chairman, faculty representatives from various cadre levels, as well as the external subject experts
Department Advisory Board (DAB)	DAB is constituted to discuss matters pertaining to Department Academic matters and other departmental activities. It will also assist the BoS	DAB meets once in a year and discusses about various academic matters and other departmental activities.	This committee consists of HOD, faculty representation from various cadre levels and external industry experts.
Programme Assessment Committee (PAC)	Responsible for the smooth running of the programme.	Interacts with key stake holders such as students, alumni and employers in assessing, establishing and revising the PEOs and POs	Consists of HOD, Programme coordinator and faculty members. Works as per the guidelines given by the HOD, Institute & VTU.
Course Co-ordinator / Course Faculty	Establishes course objectives, outcomes and assessment method and up gradation of the syllabus.	Teaching and evaluation, mapping the COs and POs and ensuring the achievement of POs	Works as per the guidelines given by the programme co-coordinator & HOD, Institute & VTU
Project Work Review Committee	Assessment and evaluation of final year student project work	Evaluation of the project work through presentation and discussions.	A Department level committee comprising of 3-4 faculty along with the guide will evaluate the project work

Quality of Semester End Examination:

In order to ensure the quality of Semester End Examinations (SEE) question papers, the following measures are taken:

- Faculty, who are setting the question paper for a particular course are given the following inputs:
  - Lesson Plan: Set by the course coordinator at the beginning of the semester.
  - Question Paper pattern: Two questions (with subsections) are to be set for 20 marks each, from each unit, with an internal choice between the two questions.
  - CO-PO Mapping
  - The questions are mapped to the cognitive levels as per Bloom's taxonomy.

- Ten questions are prepared 2 from each unit, and the students answer five full questions, one from each unit thereby covering the entire curriculum, which also ensures the coverage of all the COs defined.
- The choice questions should address the same CO.
- The external paper setter is provided with the detailed syllabus of the course for which the paper is to be set along with the guidelines to be followed by the office of the CoE.
- In each course 50% of the question papers are set by internal faculty & the other 50% by external faculty members. The request is sent from the Controller of Examinations to the internal and external paper setters.
- Board of Examination (BoE) consists of the HOD, who is the chairperson, selected internal faculty and external domain experts who are invited to review the SEE Question papers and scrutinize them for their content & quality.
- Any corrections/ clarifications are done during the BOE meeting.
- Questions from each unit of different question papers of the same course are shuffled at the CoE's office to obtain SEE, Supplementary and Makeup Question Papers.
- The proposed list of external examiners is presented in the BoS & approved therein.
- The approved list of examiners is submitted to the CoE.

- The panel of examiners both internal and external is communicated by the department to the CoE well before the commencement of the SEE.
- Upon the completion of the SEE for a course, the internal evaluator assigned will prepare the scheme and solutions and evaluate the paper, this is the first evaluation, and the second evaluation is conducted by an external examiner.
- The external examiners who are the subject experts from other academic institutes are appointed by the COE prior to the start of the SEE.
- All the PG SEE answer scripts undergo double valuation; the average of the two evaluations is used to announce the grade for that particular course.

Semester End examination (SEE): Semester end examination for theory is conducted at the end of semester for 100 marks and is scaled down to 50 marks. Semester end examination for laboratory is conducted at the end of semester for 50 marks. The sum of CIE and SEE in a given course is used to assign a grade. The process followed for maintaining the quality of SEE question paper is as follows:

Process for end semester examination paper setting and evaluation and effective process implementation

For each course four question papers are set, two question papers are set by internal faculty and another two by peer faculty, having competency in that course.
↓
The question papers are scrutinized by internal and external subject experts during the BoE meeting. During scrutiny, the BoE members make sure that the Question papers are set according to Bloom's Taxonomy & meet the COs and POs.
↓
The question papers are scrutinized for their quality and correctness during the BoE meeting. The secrecy and confidentiality of question papers is maintained and the Controller of Examinations selects the paper randomly from four sets after shuffling of questions unit wise.
↓
The evaluation of the answer booklets is done by the faculty, who has expertise in the course and has a minimum of three years of teaching experience.

Each question is mapped to the Blooms taxonomy levels and COs that in turn are used to map to the POs, as shown in the following format.

On completion of the SEE for a course the internal evaluator assigned will prepare the scheme and solution and evaluate the paper, this is the first evaluation, the second evaluation is conducted by an external examiner

All the PG SEE answer scripts undergo double valuation; the average of the two evaluations is used to announce the grade for that particular course.

The template for the SEE question paper Outcome Based Education (OBE) Analysis is provided in Fig. In this template the mapping of the questions to the relevant Bloom's levels & COs is done by the evaluator before the evaluation process commences. This information is fed into the examination automation platform called e-Sutra which facilitates the OBE analysis. Thereafter, the question wise analysis of Bloom's levels & COs for all the courses is generated.

Template for SEE Question Paper OBE Analysis

Ramaiah Institute of Technology, Bangalore – 560054
Template for SEE Question Paper OBE Analysis

Department : _____ Level: UG/PG
Course Name : _____ Date of Examination: _____
Course Code : _____ Term : _____

Question		Max. Marks	Bloom's Level (L1 to L6)	Course Outcome (CO1 to CO5)
1.	a)			
	b)			
	c)			
	d)			
2.	a)			
	b)			
	c)			
	d)			
3.	a)			
	b)			
	c)			
	d)			
4.	a)			
	b)			
	c)			
	d)			
5.	a)			
	b)			
	c)			
	d)			
6.	a)			
	b)			
	c)			
	d)			
7.	a)			
	b)			
	c)			
	d)			
8.	a)			
	b)			
	c)			
	d)			
9.	a)			
	b)			
	c)			
	d)			
10.	a)			
	b)			
	c)			
	d)			

Blooms Level (L1: Remember; L2: Understand; L3: Apply; L4: Analysis; L5: Evaluate; L6: Create)

Template for SEE question paper OBE Analysis

PROCESS TO ENSURE QUESTIONS FROM OUTCOMES/LEARNING LEVELS PERSPECTIVE

The process to ensure questions from outcomes/learning levels perspective is as follows:
Each of the CIE & SEE components cover all the Course Outcomes (COs) defined at the beginning of the semester.

- The CIE & SEE question papers are designed to ensure that the student is tested for the different cognitive levels of learning. Therefore, the elements of Blooms taxonomy are integrated in the examination assessment system.
- Each of the above said evaluation component questions satisfy different learning levels as per Bloom's taxonomy action verbs.
- Questions that are used to evaluate different cognitive levels of students may be categorized as higher order questions involving analyse, evaluate & create or lower order questions involving remember, understand & apply.
- Questions are framed using significant keywords and verbs which are useful in the determination of the suitable cognitive level.
- The project work involves all the Bloom's elements of remember, apply, analyse, evaluate & create.

EVALUATION OF SEMESTER END EXAMINATION, CONTINUOUS INTERNAL EVALUATION AND ASSIGNMENT:

Semester End examination (SEE): The semester end examination for theory courses is conducted at the end of semester for 100 marks and is scaled down to 50 marks. The semester end examination for laboratory courses is conducted at the end of semester for 50 marks. The sum total of CIE and SEE marks in a given course is used to assign a grade.
Continuous Internal Evaluation (CIE): CIE activities are spread throughout a semester and are assessed for a total of 50 marks.

Theory courses are evaluated as follows:

- 30 Marks: Two Internal Assessment tests for 30 marks each are conducted per semester for each course. The average of the two scores of the IA tests is taken.
- 20 Marks: In this component, tutorial test, quiz or other exercises like assignments, case study or presentations are given in order to promote self learning.

Quality of Assignment and its relevance to COs

- Other CIE components (Assignment / Quiz/ Presentation / Mini project) are conducted for 20 marks for each course during the semester
- The other CIE components are directed towards CO attainment and the course coordinator decides their frequency and weightage.
- Assignment/Quiz is conducted to assess the knowledge of the students about different topics which is structured and is mentioned in the course file. The assignment/quiz is also prepared in such a manner that it covers the relevant COs. Here also attempt is made to ensure that assessment is for all the COs.
- The questions are mapped to the Bloom's levels.
- The course teacher evaluates assignment/quiz and awards marks according to the answers provided by the students and follows a systematic procedure for ascertaining the relationship between the COs and POs.
- Further, each student's blue book and other CIE components are evaluated and the questions answered by the student are mapped with COs and POs using the Contineo software platform designated for this purpose by the institute.

- Some of the types of assignments given are listed below.
  - Quiz: In some of the courses quiz is planned covering the entire syllabus or few units thereby addressing the relevant COs.
  - Online quiz: Students are required to take up online quiz using Edmodo or Moodle for some of the courses.
  - Assignment: As a part of the CIE evaluation component assignments on relevant topics are given to the students. The faculty evaluates the assignment submitted & grades them accordingly.
  - Paper presentation: Some courses have paper presentation as an assessment criterion. Research or review papers published in peer reviewed journals relevant to the course are selected by the faculty and shared with the students. Students are required to read & understand the paper & make a presentation in class regarding the same.

Laboratory courses are evaluated as follows:

- 30 Marks: Continuous internal assessment for 30 marks is based on successful conduction of experiments during regular labs and record writing.
- 20 Marks: Internal laboratory test is conducted towards assessment of the remaining 20 marks which includes the viva – voce component.

PEDEGOGY FOR INNOVATIVE TEACHING AND LEARNING

PEDEGOGY FOR INNOVATIVE TEACHING AND LEARNING

All M.Tech students are required to do a project as a part of their curriculum. The students are guided to do innovative projects individually relevant to the field of Biotechnology. The students are expected to design and implement new ideas relevant to the field of Biotechnology, demonstrate their ability to solve problems within a specific time frame and, attain the communication skills in both the written and oral forms. M. Tech project work provides perfect platform for **M.Tech student where they can implement the principles of experiential & project learning tools to find innovative solution / outcome through their project work.**

During the final year a student is expected to carry out a project work with considerable complexity for the duration of 8-10 months. During fourth semester, each candidate is expected to define clear and very concise list of objectives, problem statement with title. Clear understanding of all the current and good quality papers, methodology followed, all the steps carried in the techniques, tools used, and presentation of results are expected. A general flowchart from selection of the project by the students till the final evaluation as well as selection of the best project is shown in Figure

Project work allocation & evaluation flowchart

1. **Selection of projects**

The students based on their interest in an area of expertise approach faculty members in the Department based on their domain expertise. The senior faculty members i.e., Associate Professors and Professors are allowed to guide two M.Tech project students each. The assistant Professors take one M.Tech student for guidance. Once the internal guide and external guide (if the project work is done in Industry/Institution) mutually agree to guide the student, a title, with names of the guides and place of work is submitted to the department.

2. **Evaluation of project work**

The Project Work is by far the most important work in the post-graduate programme. It provides an opportunity for the student to demonstrate independence and originality, to plan and organize work over a period and to put into practice some of the techniques learnt throughout the course.

The project work is to be done in two phases over a period of one year with Project Work-I in 3rd semester and Project Work-II in 4th semester, which may be a continuation of Project work- I. The Project work evaluation process will have periodical reviews in both semesters.

3. **Project review committee**

The quality of the student projects is assessed during the review meetings that are conducted by the project evaluation committee consisting of the HoD, who is the chairperson and three senior faculty members. The evaluation committee completes the assessment as per the guidelines and rubrics fixed. The Project Work Review Committee conducts the reviews for the students within the stipulated period. The committee also makes necessary arrangements required for the smooth conduct of reviews.

4. **Evaluation of M.Tech project work-I**

Students register for the project work-I during the third semester. Students are permitted to do their project work either in-house or in a research institute/industry. The project evaluation committee constituted in the department evaluates the student project work. The students are required to give power point presentation on the problem definition, approach to the solution and plan of work. The project work is approved by the committee after the preliminary review. At the end of the semester, along with a report in the prescribed format, the students are required to give presentation covering extensive literature survey, work plan and results obtained as part of internal evaluation. The final CIE marks of 100 is scaled downed to 50.

Evaluation Criteria for M Tech Project work –1

		Inadequate	Average	Good	Excellent
Organization of (15)		Hard to follow; inadequate information (8)	The flow of information follows sequence but the organization is inadequate (10)	Information presented in logical sequence; easy to follow (12)	The Information is well organized and follows the sequence (15)
Content	**Background content 10**	The literature survey was inadequate and does not support the project work. (7)	Includes some amount of literature to the pertaining research (8)	Adequate literature and background content collected for the research topic (9)	Excellent literature collected and summarized and identified the research gaps from existing literature. (10)
	Methods 10	Methods too brief or insufficient for adequate understanding (7)	Sufficient for understanding but not clearly presented (8)	Sufficient for understanding and effectively presented with flow charts (9)	Sufficient for understanding and exceptionally presented in figures and flow charts (10)
	Results (figures, graphs, tables, etc.) 10	Has not used tables, figures and graphs to present the results (7)	Uses some tables/graphs/ figures to present results without legends (8)	Uses tables, graphs and figures to present the results in the text with appropriate legends (9)	Uses tables, graphs and figures with legends that explain and reinforce the results and project work (10)
Presentation (25)		Sentences are poorly written; there are numerous incorrect word choices and errors in grammar, punctuation and spelling Very inadequate presentation style (19)	Sentences are generally well-written; there are few incorrect word choices and errors in grammar, punctuation and spelling Inadequate explanation in some parts of the presentation (21)	Sentences are generally well-written but Presentation has errors Most of the seminar well Paced and adequate explanation for most part of the presentation (23)	Sentences are well-written; there are no incorrect word choices and the text is free of errors in grammar, punctuation, and spelling. Appropriate, Well-paced throughout and an excellent explanation of the research idea and the results obtained (25)
Interaction (10)		Does not have grasp of information; answered only rudimentary questions (7)	At ease with information; answered most questions (8)	Able to answer most of the questions but failed to elaborate and had an adequate grasp on the project work (9)	Demonstrated more than adequate knowledge and had a good grasp on the project; answered all questions with explanation (10)
Report (20)		Hard to follow and sequence of information is not clear (14)	Paragraphs are poorly organized; flow of information is just about adequate (16)	Paragraphs are usually well-organized; use of sections is logical and flow of information is appropriate and easy to follow (18)	All paragraphs are well-organized; use of sections is logical and flow of information is excellent (20)

Evaluation criteria for M Tech Project work – 2

- **Evaluation criteria for M Tech project work -2 (Phase – 1)**

Project phase I evaluation is carried out by a project assessment committee. Each project is evaluated according to the rubrics. This phase is evaluated for 10 marks which includes problem identification, review of literature and defining the objectives of the project with brief methodology. The rubrics table for Phase I is given in Table 1.2.2b.

- **Evaluation criteria for M Tech project work -2 (Phase – 2)**

Phase II of the review is conducted to evaluate the progress of the project work. This phase is evaluated for 30 marks. Students are required to give a presentation on and progress of the project work as per plan, methodology, and results if any. The rubrics table for Phase 2 is given in Table 1.2.2c.

- **Evaluation criteria for M Tech project work -2 (Phase – 3)**

Phase III of the review is conducted to evaluate the project work. This phase is evaluated for 60 marks. Students are required to give a presentation on the project work, methodology and detailed results. A draft copy of the report submitted by the student is also evaluated during this phase and suggestions are given. The rubrics table for Phase 3 is given in Table 1.2.2d. The rubrics for project evaluation by the internal guide is given in Table 1.2.2e.

The final CIE marks of 100 is scaled downed to 50. This comprises of 100 marks valuation given by the committee members during the 3 phases (10, 30 and 60), scaled down to 60marks and 100-marks valuation of guide marks scaled down to 40. The CIE is based on 40% marks awarded by the internal guide and 60% marks by the project evaluation committee.

Once the projects are approved by the project assessment committee and the internal guide, the dissertation reports prepared by the students and attested by both the internal and external guides are submitted to the Department of Biotechnology for further processing.

Evaluation Criteria for M Tech Project work-2: Phase - 1 Maximum Marks:

10

Sl. No	Assessment Component	Assessment Criteria & Marks				
		Excellent (4)	**Good (3)**	**Average (2)**	**Acceptable (1.5)**	**Unacceptable (1)**
1	Identification of Problem and Detailed Analysis	Detailed and extensive explanation of the purpose and need of the project	Good explanation of the purpose and need of the project	Average explanation of the purpose and need of the project	Moderate explanation of the purpose and need of the project	Minimal explanation of the purpose and need of the project
2	Study of the Existing literature and Feasibility of Project Proposal	**Excellent (3)**	**Good (2.5)**	**Average (2)**	**Acceptable (1.5)**	**Unacceptable (1)**
		Detailed and extensive literature review of the existing systems	Collects a great deal of information and good study of the existing systems	Moderate study of the existing systems; collects some basic information	Explanation of the specifications and the limitations of the existing systems not very satisfactory; limited information	Minimal explanation of the specifications and the limitations of the existing systems; incomplete information
3	Objectives and Methodology of the Proposed Work	**Excellent (3)**	**Good (2.5)**	**Average (2)**	**Acceptable (1.5)**	**Unacceptable (1)**
		All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified	Good justification to the objectives; Methodology to be followed is specified but detailing is not done	Incomplete justification to the objectives proposed; Steps are mentioned but unclear; without justification to objectives	Only Some objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are not specified properly	Objectives of the proposed work are either not identified or not well defined; Incomplete and improper specification

Evaluation Criteria for M Tech Project work-2: Phase - 2 Maximum Marks: 30

Sl. no	Assessment Component	Assessment Criteria & Marks				
1	**Methodology (15)**	**Excellent (15)**	**Good (12)**	**Average (9)**	**Acceptable (6)**	**Unacceptable (3)**
		Selection of methods Detailed and extensive explanation	Selection of methods Good explanation	Selection of methods Average explanation	Selection of methods Moderate explanation	Selection of methods Minimal explanation
2	**Planning of Project Work (10)**	**Excellent (10)**	**Good (8)**	**Average (6)**	**Acceptable (4)**	**Unacceptable (2)**
		Time frame properly specified and being followed Appropriate distribution of project work	Time frame properly specified and being followed inappropriate Distribution of project work	Time frame Properly specified, but not being followed Distribution of project work uneven	Time frame properly specified, but not being followed Uneven distribution of project work and no synchronization	Time frame not properly specified Inappropriate distribution of project work
3	**Presentation (5)**	**Excellent (5)**	**Good (4)**	**Average (3)**	**Acceptable (2)**	**Unacceptable (1)**
		Objectives achieved as per time frame Contents of presentations are Appropriate and well-arranged Proper eye contact with audience and clear voice with good spoken language	Objectives achieved as per time frame Contents of presentations are appropriate but not well arranged Satisfactory demonstration, clear voice with good spoken language but eye contact not proper	Objectives achieved as per time frame Contents of presentations are Appropriate but not well arranged Presentation Not satisfactory and average demonstration	Objectives not Achieved as per time frame Contents of presentations are not appropriate Eye contact with few people and unclear voice	No objectives Achieved Contents of presentations are not appropriate and not well delivered Poor delivery of presentation

Evaluation Criteria for M Tech Project CIE Phase - 3 Maximum Marks: 60

Sl. no	Assessment Component	Assessment Criteria & Marks				
1	**Project Demonstration and Incorporation of Suggestions (20)**	**Excellent (20-15)**	**Good (15-12)**	**Average (10-9)**	**Acceptable (8-10)**	**Unacceptable (6)**
		All defined objectives are Achieved Changes are made as per modification suggested during midterm evaluation and new innovation ns added	All defined objectives are achieved Changes are made as per modifications suggested during midterm evaluation and good justification	All defined objectives are achieved All major changes are made as per modifications suggested during mid-term evaluation	Some of the defined objective s are achieved Few changes are made as per modifications suggested during midterm evaluation	Some of the defined objective s are achieved Suggestions during midterm evaluation are not incorporated
2	**Project report (30)**	**Excellent (25-30)**	**Good (20-22)**	**Average (18-20)**	**Acceptable (16-18)**	**Unacceptable (15)**
		Project report is according to the specified format References and citations are appropriate and well mentioned	Project report is according to the specified format References and citations are appropriate but not mentioned well	Project report is according to the specified format but some mistakes In-sufficient references and citations	Project report is not fully according to the specified format Insufficient references and citations	Project report not prepared according to the specified format References and citations are not appropriate
3	**Presentation (10)**	**Excellent (10)**	**Good (8)**	**Average (7)**	**Acceptable (6)**	**Unacceptable (5)**
		Contents of presentation are appropriate and well delivered Proper eye contact with audience and clear voice with good spoken language	Contents of presentation are appropriate and well delivered.Clear voice with good spoken language but less eye contact with audience	Contents of presentation are appropriate but not well delivered Eye contact with few people and unclear voice	Contents of presentations are not appropriate Eye contact with few people and unclear voice	Contents of presentations are not appropriate and not well delivered Poor delivery of presentation

Internal Guide's Evaluation (100 marks): Criteria for internal guide evaluation is as follows:

Evaluation of the Project Work by guides **Maximum Marks: 100**

Self Motivation and Determination (10)	**Technical Knowledge and Awareness related to the Project(10)**	**Literature survey and plan of work (15)**	**Implementation of experimental work (35)**	**Punctuality / regular updates (15)**	**Organization of report (15)**	**Remarks**
High involvement in identifying research problem and designing and focus on performing experiment to result to address the problem. (10)	Identifies multiple approaches for solving the problem that apply within a specific context. (10)	Collects a great deal of information--all relates to the topic. (15)	Effectively used most relevant methods to address the problem and possible alternative methods of working on the problem. able to recognizes problems during the conduction of experiment and successfully troubleshoot them (35)	Regular attendance and punctual in performing and updating experimental results.(15)	Fully & imaginatively supports thesis & purpose. Sequence of ideas is effective. Transitions are effective (15)	Excellent
Active Involvement in identifying research problem and designing and performing experiment to result to address the problem.(8)	Identifies multiple approaches for solving the problem, only some of which apply within a specific context. (8)	Collects some basic information--most relates to the topic. (12)	Successfully used most relevant methods to address the problem and able to explain principles and application of methodology and able to recognizes problems during the conduction of experiment and tried to troubleshoot them. (30)	Regular attendance and punctual in performing and not updating experimental results(12)	Organization supports thesis and purpose. Transitions are mostly appropriate. Sequence of ideas could be improved (12)	good
Moderate Involvement in identifying research problem and designing and performing experiment to result to address the problem.(6)	Identifies only a single approach for solving the problem that does apply within a specific context. (6)	Collects very little information-- some relates to the topic. (9)	Identifies some but not all methods required for dealing with the issue; does not explain why they are relevant or effective. (25)	Irregular attendance but good in performing and updating experimental results.(9)	Some signs of logical organization. May have abrupt or illogical shifts & ineffective flow of ideas (9)	average
poor Involvement in identifying research problem and designing and performing experiment to result to address the problem (4)	Identifies one or more approaches for solving the problem that do not apply within a specific context. (4)	Does not collect any information that relates to the topic (6)	Fails to explain how/why/which specific methods of research are relevant to the kind of issue at hand. (20)	Irregular attendance and poor in performing and updating experimental results.(6)	Unclear organization OR organizational plan is inappropriate to thesis. (6)	poor

Evaluation of project work – 2 (SEE)

The Department of Biotechnology once it receives the dissertation reports duly signed by HoD, internal guide and external guide sends it to the Examination section of the Institute. The Department in consultation with the internal project guide will identify Professionals and domain experts available in other institution and organizations and send these reports to them for evaluation purposes. The Examination section dispatches the reports to the domain experts and the project is also evaluated by the internal guide in consultation with the external guide. The domain experts and the internal guide evaluate the project for 100 marks each. When the evaluation reports are received from the internal guide and domain experts, the internal guide in consultation with the Head of the Department fixes the date for viva voce of the student. Based on the student performance in viva voce, marks are awarded for 100.

Rubrics for the evaluation of the project work (SEE):

The criteria for evaluation is decided by the respective panel. Generally the examiners look for relevance of the project to the field of biotechnology, its real time application to food, health, environment and other allied fields. Students with publication in national / international journals or presentations in national/international conference/ workshop are appreciated. Some common evaluation criteria taken into account by the panel of examiner are listed below:

- Relevance of the topic
- Systematic plan of work and execution
- Data analysis and interpretation
- Sound conclusion and future directions
- Viva voce
- Presentation skills
- Report writing skills

Quality of completed projects: The quality of the completed student projects are assessed by considering the following parameters:

i. Acquisition of funding for the project work
ii. Projects that receive any awards
iii. Projects eventually leading to quality publications in peer reviewed indexed journals.
iv. Projects carried out in industry/institutes of national repute

***Funded Student Projects*:** Students are encouraged to apply and avail funding for their project work from KSCST, VTU project funding scheme, MSRITAA project funding etc. Some of the funded student projects are given in following Table

Funded Student Projects

Year	Name and USN No.	Title of the Project	Amount Sanctioned
List of projects sanctioned under Karnataka State Council for Science & Technology (KSCST)			
2023	Akshaya.A 1MS21BBT01	In vitro biocompatibility studies on pla-chitosan Scaffold for neuronal growth and adhesion	Rs. 6000
2021	Amrutha U 1MS19BBT01	Development of a low cost and green process for extraction of quercetin from domestic biodegradable waste	Rs. 6000
2020	Arpitha R 1MS18BBT01	QPCR analysis of genes expressed during biofilm development of *Candida albicans*	Rs. 5500
List of projects sanctioned under M S Ramaiah Alumni Association (MSRITAA)			
2023	Aparna Srinath 1MS21BBT05	Synthesis of Inorganic Quantum Dots and its application as optical sensor for antibiotics	Rs. 5000
2022	Amulya B Reddy 1MS20BBT02	Liver Targeted Delivery of Phyllanthin	Rs. 5000
2021	Tanuja B R 1MS19BBT12	Influence of Surface modification on Anti-microbial activity of nano Titanate based ceramic	Rs. 5000
2020	Premchand S C 1MS18BBT03	Chitosan conjugated nano zirconium titanate ceramic coating materials for orthopaedic implants	Rs. 5000
2019	Bhupendra Y 1MS17BBT04	Investigation of *Piper cubeba* for antiviral activity by targeting Dengue viral protease	Rs.5000

STUDENT PUBLICATION DETAILS IN SCI/WEB OF SCIENCE INDEXED JOURNALS

Sl. No.	Publication Details: [Name of the author, Title, Journal name, Volume, Page number, Year]	Impact Factor	Q Ranking
1	Hema Jayanna Nelagadarnahalli, Geno Kadwin Jacob, Dhamodhar Prakash, Joe Antony Jacob et al., "Optimization and fabrication of silver nanoparticles to assess the beneficial biological effects besides the inhibition of pathogenic microbes and their biofilms" Inorganic Chemistry Communications, Volume 156, 2023, 111140, ISSN 1387-7003		Q2
2	Savinay, K.J., Prakash, D., Akash, S., and Hema, J.N. 2023. Production, characterization and optimization of red pigment Echinenone produced by Micrococcus sp., isolated from soil. Nat. Life Sci. Commun. 22(2): e2023025.		Q3
3	**Charishma C Gowda, Lavanya B**, Chandra Prabha M N, R Hari Krishna and Monika P, Bioceramics in Hip and Knee Implants, Journal of Mines, Metals and Fuels, 2023, 71(1): 400-407.	-	Q4
4	**Krishna, Swati**, TP Krishna Murthy, G. Divyashri, Manikanta Murahari, Rohit Shukla, S. Birendra Kumar, and Tiratha Raj Singh. "Pharmacoinformatics based screening of combined synthetic and natural compounds to identify novel and in silico potential Bcl-2 inhibitors." *Journal of Molecular Liquids* 366 (2022): 120250.	6.633	Q1
5	Krishna, R. Hari, M. N. Chandraprabha, Prakash Monika, **Tanuja Br**, Vishal Chaudhary, and C. Manjunatha. "Biomolecule conjugated inorganic nanoparticles for biomedical applications: A review." *Biotechnology and Genetic Engineering Reviews* (2022): 1-42.	4.55	Q1
6	Chandraprabha M N, Hari Krishna R, Samrat K, Pradeepa K, **Neelashree,** Sasikumar M, 'Biogenic collagen-nano ZnO composite membrane as potential wound dressing material: Structural characterization, antibacterial studies and in vivo wound healing studies', Journal of Inorganic and Organometallic Polymers and Materials, 2022, https://doi.org/10.1007/s10904-022-02351-8.	3.518	Q2
7	Hari Krishna, R., Chandraprabha, M.N., Mamatha, G.M., Malappa M, **Deepa Kundagol**, Manjunatha C, Non-enzymatic Catalytic Oxidation of Glucose and Dual Mode Sensing by Fluorescence/Electrochemical Methods Using MO–GO Composites (MO = ZnO, CuO, NiO and Co 3 O 4). Topics in Catalysis, 2022. DOI: 10.1007/s11244-022-01588-4	2.781	Q1
8	**S. Farhat Afsar**, M. N. ChandraPrabha, R. Hari Krishna, Bhargavi Vadappi, synthesis, characterization of nano zinc sulphide and evaluation of DNA binding interactions, ECS Transactions, 2022, 107, 15999.	-	Q4

9	Kallur, Misba, **M. N. Chandraprabha**, Hari Krishna Rajan, Ajit Khosla, and C. Manjunatha. "Synthesis, Characterization of Cerium Oxide Nanoparticles and Evaluation of DNA Binding Interactions." *ECS Transactions* 107, no. 1 (2022): 15935.	-	Q4
10	TP Krishna Murthy, Afraa Aqeel Zackria, Bala Mohan Sivani, Priyanka Venkatesh**, Ramya Pattabiraman,** S Birendra Kumar, Parasuraman P, G Divyashri. "In silico screening of natural compounds from Curcuma amada Roxb for inhibition of Helicobacter pylori: Molecular docking, dynamics and ADMET studies." *International Journal of Pharmaceutical Research* 14 (1), (2022): 124-141.	-	Scopus Indexed
11	**Krishna, Swati**, S. Birendra Kumar, TP Krishna Murthy, and Manikanta Murahari. "Structure-based design approach of potential BCL-2 inhibitors for cancer chemotherapy." *Computers in Biology and Medicine* 134 (2021): 104455	6.698	Q1

Student Book Chapters details

Sl. No.	Book chapter Details: [Name of the author, Title, Journal name, Volume, Page number, Year]
1	**Shraddha Shah**, Chandraprabha M. N., and Samrat K, Assessment of Antibacterial and Antifungal Activity of Zero Valent Iron Nanoparticles, in 'Nanomaterials: Physical, Chemical, and Biological Applications', CRC Press (Taylor & Francis) & Apple Academic Press, 2018, Chapter 13

Projects carried out in Industry/Institutes of National repute

Students also carry out their project in industries and various academic institutes of national repute. These institutes select the students based on their specific selection criteria. The list of these projects carried out is listed in Table

List of projects carried out in industry/institutes of national repute for the

Sl.No	Name and USN No	External Guide	Title of the major project work
Batch 2020-2022			
1	Ayana E K 1MS20BBT04 Guide: Dr. Lokesh K N	Dr. William R Surin Principal Research Scientist, Department of Microbiology and Cell Biology, Indian Institute of Science Bengaluru	Investiation of the potential role of VAV3 protein in platelet adhesion, activation and thrombus formation.
2	Saba Anjum 1MS20BBT10 Guide: Dr. Bindu S	Dr. William R Surin Principal Research Scientist Department of Microbiology & Cell Biology IISc, Bengaluru-560010	To study the collagen platelet activation by various inhibitors and anticoagulatory effects of phytochemicals
Batch 2019-2021			
1	C Shashanka 1MS19BBT03 Guide: Dr. Ahalya N	Akash S Senior Scientist, BIOPOL BIOSCIENCES, Bangalore Bioinnovation Centre (BBC), HELIX BIOTECH Park, Electronic City PHASE 1, Bengaluru	Blending and formulation of various types biodegradable polymers
2	Krutika I N 1MS19BBT05 Guide: Dr. Priyadarshini Dey	Mr. Basavanagowda M.G. Horticulture scientist, ICAR -Taralabalu krishi kendra, Davangere.	Development of growth promoting bio stimulants using domestic wastes
3	Pankaj P S 1MS19BBT07 Guide: Dr.Samrat K	Dr. L. Sivarama Prasad & Dr. B. Reddaiah, Lead Scientist and Scientist AgriGenome Labs Pvt. Ltd. Hyderabad, Telangana State-50010.	Molecular evaluation of rice (oryza sativa l) gremplasm for biotic and abiotic stress

4	Raksha Rajagopal 1MS19BBT08 Guide: Dr.Bhavya S G	Dr. N. Ravi Sundaresan Associate Professor, IISc, NRS lab, Department of molecular biology and cell biology	Association of SIRT1 single nucleotide polymorphisms with dilated cardiomyopathy in Indian population
5	SooryaSankar 1MS19BBT09 Guide: Dr. P. Dhamodhar & Dr. Ahalya N	Mr AKASH S Senior Scientist, BIOPOL BIOSCIENCES, Bangalore Bioinnovation Centre (BBC), HELIX BIOTECH Park, Electronic City PHASE 1, Bengaluru	Optimization and Production of polyhydroxybutyrate (PHB)
Batch 2018-2020			
1	Hanna Abdul Hakeem 1MS18BBT03 Guide: Mrs. Bhavya SG	Mr. Sharath Kumar LM Research scientist Department of Phytochemistry The Himalaya Drug Company Makali, Bengaluru	Integrated extraction approach for isolation of phytocompounds from Glycyrrhiza glabra (licorice) root: An opportunity in the application of skincare products
2	Ramya K 1MS18BBT06 Guide: Dr. Priyadarshini Dey	Dr. Malali Gowda Dean MSRUAS	Study of HLA Genes in south Indian Population
3	Sheersha Sivdas 1MS18BBT08 Guide: Dr P Dhamodhar	Dr Rakhi P Chief Technical Officer (CTO) Center for Brain Development and Research (CBDR) InStem, Bangalore.	"Study on astrocyte secretory protein and oxidative stress in fragile x syndrome"
4	Shivali M B 1MS18BBT09 Guide: Dr Ahalya N	Mr. Sharath Kumar LM Research Scientist Department of Phytochemistry The Himalaya Drug Company, Makali, Bangalore	Isolation of natural allantoin from the tubers of Dioscorea bulbifera: A natural moisturising agent for skincare products

5	Sneha Judith 1MS18BBT10 Guide: Dr. Abhijith SR	Dr. N Ravi Sundareshan Assistant Professor Department of Microbiology and Cell Biology IISC, Bengaluru	"Understanding the effect of nutrient starvation on the biogenesis of lysosomes in HELA cells."

INITIATIVES RELATED TO INDUSTRY INTERACTION INCLUDING INDUSTRY INTERNSHIP/SUMMER TRAINING

The Department of Biotechnology has taken several initiatives to strengthen the Industry – Institute interaction. The following sections presents the Industry involvement and their impact on the teaching learning process.

1. Industry supported laboratories
2. Participation of Industry professionals in programme design and curriculum development
3. Industry involvement in partial delivery of courses for students
    a. Industry/Academia of national repute involved in the partial delivery of subjects
    b. Industry Collaborated Activities (Hands on Training Workshops/Lecture series)
4. Impact Analysis of Industry Institute Interaction
5. Industrial Visits
6. Internship/Summer Training
7. Impact Analysis of Internship
8. Student Feedback on Industry - Institute Initiatives & Programmes

1. Industry Supported Laboratories

The Department is actively involved in partnering with many leading industries in Bangalore for Internships and training. Industry supported laboratory is shown here in Table 1.2.3.1A. This laboratory is used by the UG, PG and the faculty for regular class work, conduction of workshops and for research purpose.

The Department of Biotechnology, Ramaiah Institute of Technology has been sanctioned the BiSEP (Biotechnology Skill Enhancement Programme) programme by KBITS, Department of IT, BT and S&T, Government of Karnataka with a sanctioned budget of Rs.162.5 Lakhs to impart industry-oriented skill-upgrading training to graduates and post-graduates of biotechnology. The nature of financial support provided includes a financial support upto Rs.1.00 crore for procuring equipment/s relevant to the Biopharmaceutical Technology domain for developing laboratory infrastructure and Rs.10.00 lakhs per year towards nonrecurring expenditure which includes Manpower/Consumables/Contingency. BiSEP laboratory has been established in the department, where the equipment procured through the funds are housed. The Department has MoUs / Consent letters from several reputed

industries, which is appended in following table

Industry supporting BiSEP Programme

S.No	Supporting Industries for BiSEP
1	**Biocon Limited**, Bengaluru.
2	**Hindustan Unilever Limited (HUL),** Bengaluru
3	**The Himalaya Drug Company,** Bengaluru
4	**Sami Labs Ltd,** Bengaluru
5	**Connexios Life Sciences**, Bengaluru
6	**Genotypic Technology Pvt. Ltd,** Bengaluru
7	**Gangagen Biotechnologies Pvt. Ltd,** Bengaluru
8	**Aristogene Biosciences Pvt.Ltd,** Bengaluru
9	**Acquity Labs Pvt. Ltd,** Bengaluru
10	**Celest Pharma Labs Private Limited,** Bengaluru

INDUSTRY INVOLVEMENT IN PARTIAL DELIVERY OF REGULAR COURSES FOR STUDENTS:

The Department is continuously engaged in partnering with the industry for different activities, one of them being partial delivery of courses of both UG and PG curriculum. These events provide an opportunity for interaction with eminent researchers& scientists from industry. Discussion on the latest advances in the field with these experts assists in upgrading the curriculum and also in providing opportunities for student internships and project work with the industry. The details of partial delivery of courses for students by industry experts is given in Table 1.2.3.3A.

The details of Industry involvement in Partial delivery of courses

Sl. No.	Name of the Invited Expert	Title of the Lecture delivered	Date of the Lecture	Contributing to Courses
1	Dr. Sundaram Chief Scientific Officer, Ingex Labs	Advances in Bioanalytical Techniques and their applications	24.04.2023	MBT11 Bioseparations and Bioanalytical Techniques
2	Mr. Akshay Doiphode Spincotech	HPLC	25.04.2023	MBT11 Bioseparations and Bioanalytical Techniques
3	Mr. Manohar. N Spincotech	LC -MS	26.04.2023	MBT11 Bioseparations and Bioanalytical Techniques
4	Dr. Sujay Prasad Director NARL & NAALM	Mass spectrometry	27.04.2023	MBT11 Bioseparations and Bioanalytical Techniques
5	Dr. KNC Murthy Dean, NAALM	Identification of microbes using MALDI	28.04.2023	MBT11 Bioseparations and Bioanalytical Techniques

6	Dr. Gen Sheldon Vaz Consultant Pathologist, NAALM	FACS & Cell counter and their applications	28.04.2023	MBT11 Bioseparations and Bioanalytical Techniques
7	Dr. Raghupathy, Senior Scientist, Central Electrochemical Research Institute, Karaikudi, TN	Electrocatalysis	10.03.2023	MBTP Project Work
8	Mr. Pradeep K.G Regional Manager (Sales & Marketing), Biologic Science Instruments Pvt. Ltd, Bengaluru	Energy Storage	10.3.2023	MBTP Project Work
9	Mr. Abhiram Service Engineer Biologic Science Instruments Pvt.Ltd,	Bioelectrochemistry	11.3.2023	MBTP Project Work
10	Dr. Rustam Shekar Applications Engineer II COMSOL Multiphysics Pvt.Ltd	Applications of COMSOL Multiphysics in Biotechnology	09.11.2022	MBTP Project Work
11	Dr. Shankar Pattabhiraman Technical Product Manager Ceckman Coulter Life Sciences Pvt Ltd.	Flow Cytometry application techniques in diagnosis and bio-pharmaceuticals	20.2.2021	MBTOE02 Recombinant DNA Technology
12	Ms. Namrutha Guruprasad Process Engineer Merck Life Sciences Pvt. Ltd	Diverse Fields in Biotechnology	23.1.2021	MBTE03 Advanced Downstream and Upstream Technology

13	Dr. Shailesh Dudhagaonkar Associate Research Director Bristol Myer Squibb, Bengaluru	Immuno oncogenes and Immuno Modulators	28.2.2020 and 17.3.2020	MBTE04 Medical Biotechnology MBT22 Biopharmaceutical Technology
14	Dr. Prakash Subramanyan, Senior PI, Bristol Myers Squibb, Bengaluru	Genome Editing	18.2.2020	MBTE04 Medical Biotechnology
15	Ms. Ankitha Channabasappa Development scientist Beckman Coulter Life Sciences , Bengaluru	Experiences in Pharmaceutical Industry	25.1.2020	MBTP Project Work
16	Dr. Madhav Ram Prananandi Senior Director, Kemwell Biopharma Ltd	Biologics Manufacturing: Developing and delivering next generation medicines	28.11.2019	MBTE09 Recombinant DNA Technology
17	Prof. SriramRajagopal, Jubilant life Sciences	Accelerating Drug Discovery Research through a system biology Approach	23.9.2019	MBTE09 Recombinant DNA Technology

The details of the experts from R& D Institutes in the partial delivery of courses for students

Sl.No	Expert from Academia	Lecture Topic	Date	Contributing to courses
1.	Prof. R. Sowdahamini Faculty Scientist, NCBS	Swapping of domains: Analysis and Prediction (in Protein)	7.01.2022	MBT 32 Project Work – Phase I
2.	Dr.BhupendraVerma Department of Biotechnology, All India Institute of Medical Sciences, New Delhi	Genome Editing Technologies	09.07.2021	MBTE12 Protein Engineering and Industrial Applications
3.	Dr.Kruthika Vinod T P Scientist C, Dept of Neurochemistry, NIMHANS, Bengaluru	Genetic profiling of GlutaricAcidemia type I: A study from India	09.05.2021	MBTE04 Medical Biotechnology
4.	Dr.Gopinath Packirisamy Associate Professor, IIT Roorkee,	Methods to study the toxicity of nanomaterials	18.12.2020	MBTE01 Industrial and Environmental Biotechnology
5.	Dr. Narendrakumar Ramanan Associate Professor, Centre for Neuroscience, IISC, Bengaluru	Neuroprotective Reactive Astrocytes in Neural Injury and Neurodegenarative disorders	27.11.2020	MBTE02 Recombinant DNA Technology
6.	Dr. Shahul Principal Scientist and Technical Head, Wisecorner Laboratories Pvt. Ltd. Chennai	Protein Engineering for Biotech Industry	24.07.2020	MBTE02 Recombinant DNA Technology
7.	Dr. Dipankar Nandi Professor IISC	T cell co-stimulation, anti-tumor responses and the 2018 Nobel	28.02.2020	MBT22 Biopharmaceutical Technology

		Prize		MBTE04 Medical Biotechnology
8.	Dr. Filippo Prischi Senior Lecturer, United Kingdom	Biochemistry of Macromolecules	07.02.2020	MBTP Project Work

R& D Institutes in the partial delivery of courses for students (SCREEN SHOTS)




Industry Collaborated Hands on Training Workshops

Sl. No	Date	Title	Collaborator
1	10th – 12th August 2023	Workshop on "Insilico Drug Design"	Institution of Engineers (Student Chapter, RIT)
1	24th - 28th April 2023	Workshop on "Advances in Bioanalytical Techniques and their applications"	Bangalore Bioinnovation Centre & Neuberg Anand Academy of Laboratory Medicine.
2	23rd – 30th January 2023	Hands on Training on "Mammalian Cell Culture-Best practice"	Merck Life Sciences, Bengaluru.
3	13th to 15th Sep 2021	Workshop on 2D gel Electrophoresis	Biorad Laboratories
4	7th Feb 2020	Training program on Instrumentation Working &Applications of Freeze Dryer	Roshtec Life Science, Bengaluru
5	5th to 6th March 2020	Hands on training program for Students on Next Generation Sequencing	Bengaluru Genomics Centre, Bengaluru
6	3rd Dec 2019	Basic of Chromatography, Instrumentation & Applications of HPLC	Spinco Biotech Pvt Ltd, Bengaluru
7	7th Dec 2019	Training programme on Instrumentation Working and Applications of Flame Photometer	Aspire Inc, Bengaluru
8	3rd – 10th Aug 2019	Analytical techniques in Biopharmaceutical Technology	The Himalaya Drug Company, Beckman Coulter & Acquity Labs, Bengaluru

Industry Collaborated Lecture Series

Sl. No	Date	Title	Collaborator
1	28 March 2023 – 1st April 2023	International Webinar Series on "Current Trends and Advancements in Food & Biotechnology"	Department of Food Technology, Karpagam Academy of Higher Education. Coimbatore, Tamil Nadu
2	7th & 9th June 2022	Impact Lecture Series on the occasion of "World Environmental Day"	Department of Mechanical Engineering, RIT & IEI MSRIT Student Chapter
3	29th April 2022	Seminar and Training on "Placement opportunities in drug development industries"	The White Board, Bengaluru
4	26 March, 08 & 21 April, 05 May 2022	Lecture Series on "Industrial perspectives on Biopharmaceutical processes and applications"	Merck Life Sciences, Bengaluru
5	21st to 25th March 2022	5 days International webinar series on "Emerging trends in Biotechnology advancements"	Institute of Engineers India-Student Chapter, RIT, Bengaluru
6	7th to 11th March 2022	One Week Workshop "Advances in Characterization techniques and applications: A material science perspective"	Shriram Institute for Industrial Research, Bengaluru
7	10th Jan to 4th Feb 2022	Drug Discovery and Development	Biocon-Bristol-Myers Squibb India Ltd, Bengaluru
8	4th to 9th Oct 2022	Recent Advances and opportunities in Industrial Biotechnology	Association of Biotechnology Led Enterprises (ABLE)
9	4th to 9th Oct 2021	Advances and Applications of NanoBiotechnology	Department of Chemistry, RIT and Indian Institute of Chemical Engineers, Kolkata
10	6th to 11th Jan 2020	Downstream Processing of Natural Products: Research and Industrial	The Himalaya Drug Company, Bengaluru

		Applications, Biosafety, GLP and Regulatory Affairs	
11	25th to 2nd June 2020	Drug Discovery & Development in the Wake of Pandemics	Biocon-Bristol-Myers Squibb India Ltd, Bengaluru
12	22nd to 27th June 2020	Immunomodulatory Functional Foods & Nutraceuticals	IEEE-EMB, MSRIT, The Himalaya Drug Company, Novozymes, CFTRI, DRDO and NDRI
13	24th to 28th July 2020	Plant and Equipment Design	ChemTex Consulting of India (P) Ltd
14	29th to 31st July 2020	Docking, QSAR and Molecular Dynamics	Faculty of Pharmacy, Ramaiah University of Applied Sciences
15	10th to 14th Aug 2020	Five days e-workshop on "Emerging Applications of Nanomaterials	Department of Chemistry in association with IQAC &under IEEE-EMB MSRIT Student Chapter
16	26th to 30th Oct 2020	Workshop on on Nanotechnology in Biomedical Applications	University of Illinos, Chicago, USA
17	5th to 7th Sep 2020	Recent Trends and Technologies in Biotechnology and Allied Sciences	AICTE sponsored E-Conference
18	28th to 2nd Feb 2019	Recent Advances in Nutraceuticals & Functional Foods	The Himalaya Drug Company, Bengaluru
19	12th March 2019	Basic Molecular Biology Techniques	Faculty of Dental Sciences, MSRUAS, Bengaluru
20	17th to 22nd June 2019	2D and 3D Models of Cell Culture and their Applications	ReaGene Biosciences Pvt. Ltd. and HiMedia Laboratories Pvt. Ltd., Bengaluru
23	03rd to 10th Aug 2019	Analytical techniques in Biopharmaceutical Technology	The Himalaya Drug Company, Beckman Coulter & Acquity Labs, Bengaluru,
21	29th to 30th Aug 2019	Nanomaterials - Applications in Biotechnology	Indian Academy of Sciences, Bengaluru, Indian National Science Academy, New Delhi & The National Academy of Sciences India, Allahabad

Experts from industries delivering talks as a part of collaborative Hands – on Training/Lecture Series

Impact analysis of Industry Institute Interaction

The Industry Institute interaction has resulted in Industry experts being involved in the program design and curriculum development, industrial visits, workshops, placement and internship for students and MoUs being signed between the Department and Industry. The interactions of Department of Biotechnology and the various Industries are given in Figure

Industry – Institute Interactions

The outcomes of interaction with experts from industry/ Institution of repute is presented in Table

The outcomes of interaction with experts from industry/ Institution

Industry	Interactions
Novozymes	1. Representation in DAB & BOS 2. Inputs on curriculum, research & consultancy projects. 3. Add on course 4. Technical workshop 5. Industrial visits 6. Student project work 7. Student Internship
The Himalaya Drug Company	1. Representation in DAB 2. Student Internship 3. Student Project work 4. Technical workshop 5. Faculty Development programs 6. Industrial visits 7. Expert Lectures 8. Industry supporting BiSEP Program
Biocon-Bristol Meyer Squibb	1. Industry sponsored research funding 2. Representation in BOS 3. Student placement 4. Partial delivery of courses 5. Lecture series 6. Technical workshop 7. Webinar
Biocon	1. Representation in BOS & DAB 2. Student placement 3. Industry supporting BiSEP Program 4. Industrial visits
Merck Lifesciences	1. MOU for research & training 2. Student Internship 3. Lecture series 4. Industrial visits
Hindustan Unilever	1. Representation in DAB 2. Industry supporting BiSEP Program 3. Student project work/Internship
Sartorius	1. Representation in DAB 2. Student Internship 3. Student Project work
Indian Institute of science	1. Representation in BOS & DAB 2. Partial delivery of courses 3. Research Mentorship – SERB- TARE 4. Joint research publications 5. Student Project work 6. Student Internship 7. Expert Lectures

List of MOUs between MSRIT and Industries

Industry	MoU duration
Merck Life Sciences	10.10.2022- 10.11.2023
Bionovid Technology Pvt Ltd, Bengaluru	30.09.2021- 30.09.2024
M/s Kemwell Biopharma Pvt. Ltd, Bengaluru	01.02.2020 – 01.02.2023
Bioman Technologies Pvt Ltd. Bengaluru	28.10.2020-20.10.2022

Details of the Industrial Visits to various Biotechnology Industries

S.No	Name of industry visited	Date /year	Outcomes
1	Anand Neuberg Laboratory Bengaluru	27.04.2023 and 28.04.2023	Students attended lecture on "Mass spectra general introduction and principles ,identification of microbes using MALDI" Students were exposed to use HPLC,LC-MS and MALDI facility
2	Bangalore Bioinnovation Centre Bengaluru	25.04.2023 and 26.04.2023	Students attended lecture on Basics of HPLC and different types of detectors" gained the knowledge of usage of shimadzu lab solution software and quantification of HPLC data
3	Bangalore Bioinnovation Centre Bengaluru	23.09.2022	Students gained the knowledge of usage of shimadzu lab solution software and quantification of HPLC data
4	Merck Life Science Bengaluru	05.07.2022	Students gained insights into the functioning of an industry, various aspects of production marketing and overall operation of a company Students were able to understand the working of the Gel Doc system

5	The Himalaya Drug Company Bengaluru	10.01.2020	Students learnt various Chromatography Techniques for development of natural Products Gained Knowledge on Animal Cell Culture
6	Centre for Cellular and Molecular Platforms (C-CAMP) Bengaluru	5.12.2019	Gained Knowledge on Biotechnology Big Incubation Centres like C-CAMP and entrepreneurship initiatives
7	Indo-American Hybrid Seeds Pvt Ltd Bengaluru	13.11.2019	Gained knowledge on development and production of hybrid seeds of vegetables, flowering plants, field crops and production of ornamental plants
8	Biocon Bengaluru	19.09.2019	Gained knowledge in developing medicines in different area such as cancer, diabetis, kidney disfunctioning and autoimmune diseases
9	The Himalaya Drug Company Bengaluru	01.02.2019	Students learnt various Chromatography Technique for development of natural Products Gained Knowledge on Animal Cell Culture

Students during Industrial Visits

Industrial Internships/Summer Training

All students undergo Internships/Industrial Training as part of their academic program. Internship is encouraged among students through the implementation of the curriculum. Students are required to undergo at least 4 – 8 weeks of internship at Research Organizations /Government training institutes / Public sector units / Reputed academic institutions / Reputed industries.

Internship Details of Batch 2020-2022 (Sample)

Sl No	USN/Name	Institute/Industry	Duration	Title
1.	1MS20BBT01 Aarthy S	Siva Labs Pvt Ltd., Coimbatore	08th September 2021 to 12th October 2021	Clinical Pathology and laboratory techniques
2.	1MS20BBT03 Ananya N Nayak	BioEdge Solutions, Bengaluru	20th Dec 2021 to 07th Jan 2022	DNA barcoding, phytochemical analysis of Basella alba and correlation with mouth ulcer
3.	1MS20BBT04 Ayana E K	Department of Microbiology and Cell Biology, IISc, Bengaluru	14th September 2021 to 15th October 2021	overview of animal handling and isolation of platelets from mice blood
4.	1MS20BBT05 Charishma C Gowda	BioEdge Solutions, Bengaluru	20th Dec 2021 to 07th Jan 2022	DNA barcoding,Study on phytochemicals and Anti-ulcer of Artocarpus heterophyllus
5.	1MS20BBT06 Dave Wilson	Honeychem Pharma Research Pvt. Ltd., Bengaluru	12th September 2021to 12th October 2021	Lidocaine synthesis mechanism
6.	1MS20BBT07 HemaJ N	BioEdge Solutions, Bengaluru	20th Dec 2021 to 07th Jan 2022	Isolation and Characyerization of cellulose degarding bacteria from plant decomposting matter
7.	1MS20BBT08 Lavanya B	BioNome, Bengaluru	19th September 2021to 07th November 2021	Complete Bioinformatics tools training
8.	1MS20BBT09 Nafisathul Misiriya A	Bioman Technologies Pvt Ltd., Bengaluru	23rd August 2021 to 3rd October 2021	Production of bioethanol from leachate collected from biodegradable waste
9.	1MS20BBT10 Saba Anjum	Bioman Technologies Pvt Ltd., Bengaluru	23rd August 2021 to 3rd October 2021	Production of bioethanol from leachate collected from biodegradable waste

10.	1MS20BBT11 Shashikala K	Nadhera Biotech, Bengaluru	01st October 2021 to 10th November 2021	Production of Moringa Seed Oil
11.	1MS20BBT12 Sindhoora B U	Diacon Hospital, Bengaluru	06th September 2021 to 29th October 2021	HPLC Instrumentation
12.	1MS20BBT13 Supriya A N	Mahatma Gandhi Clinical Laboratory, Chitradurga	04th October 2021 to 19th November 2021	Clinical Laboratory Tests

-Internship Evaluation Rubrics

Topic	Beginning (Totally unrelated)1	Developing (Remotely related)2	Accomplished (Somewhat relevant)3	Exemplary (Directly relevant)4
Organization (Overall order, flow, and transitions) **(30)**	Details and examples are not organized, are hard to follow and understand. **(20)**	Information is scattered and needs further development. **(24)**	Information is logically ordered with paragraphs and transitions. **(28)**	Information is presented in effective order. Excellent structure of paragraphs and transitions enhances readability and comprehension. **(30)**
Quality of Information (30)	Unable to find specific details. **(20)**	Details are somewhat sketchy. **(24)**	Some details don't support the report topic. **(28)**	Supporting details are specific to topic and provide the necessary information. **(30)**
Introduction (10)	Introductory paragraph is not apparent. **(7)**	Introductory paragraph is vague. **(8)**	Introductory paragraph is clearly stated with a focus. **(9)**	Introductory paragraph is clearly stated, has a sharp, distinct focus and enhances the impact of the report **(10)**
Conclusion (10)	Concluding paragraph is not apparent. **(7)**	Concluding paragraph is only remotely related to the report topic. **(8)**	Concluding paragraph follows and summarizes the report discussion and draws a conclusion. **(9)**	Concluding paragraph summarizes and draws a clear, effective conclusion and enhances the impact of the report. **(10)**
Format (10)	Document is formatted poorly and lacks a quality cover page and index **(7)**	Inconsistency in format. Improper arrangement of cover pages **(8)**	Formatting of the document is generally consistent and adequate, and includes a good quality cover page and index **(9)**	Formatting of the document is professional and includes a professional cover page and index **(10)**
Bibliography (10)	Resources not cited in paper or proper format not used.	Some resources are cited but not all. Not formatted correctly.	All resources are cited, but formatting isn't correct.	All resources are cited and appear with correct formatting.

Participation of Industry Professionals as examiners/ guides in major projects

The professionals from industries and academic research Institutes have contributed in guiding major projects and in the assessment.

Industry Professionals involved in guiding major projects

Sl.No	USN & Student Name	Industry Expert	Title of the project work
1	1MS21BBT06 B.M Karthik	Dr K N Chidambara Murthy Dean Neuberg Anand Academy of Laboratory Medicine,Bengaluru	Comparative study on diagnostic yield of FISH panel against Conventional Cytogenic studies
2	1MS21BBT07 Gopi Chand Rao	Ms Susha Dinesh Bioinformatics Associate Department of Bioinformatics Bionome, Bengaluru	Targeting Glioblastoma Multiforme with Thuja occidentails: An mRNA Differential Gene Expression Analysis and Molecular Docking Study
3	1MS21BBT13 Salome Ruth Vijayaraghavan	Dr.M.A Rashmi CEO/Founder Rashvee-International Phytosanitary Research and Services Pvt.Ltd(R-IPRS)	Study of Biology and Bio-Efficacy of Botanicals against Major Insect Pests in Urban Gardens and Horticultural Crops
4	1MS21BBT02 Ananya N A	Mr.Veeresh Nandikolmath Scientist and Research Director Stroma Biotechnologies Pvt. Ltd.Bengaluru	Antiproliferative properties and cell cycle induced by medically relevant Quinoline derivative against lung cancer
5	1MS21BBT10 Rakshitha A	Mr.Veeresh Nandikolmath Scientist and Research Director Stroma Biotechnologies Pvt. Ltd.Bengaluru	Assessment of Anti-tumor activity of Quinoline derivative
6	1MS19BBT03 C Shashanka	Akash S, Senior Scientist, BIOPOL Biosciences, Bangalore Bioinnovation Centre (BBC), Helix Biotech Park, Electronic City phase 1, Bengaluru	Blending and formulation of various types biodegradable polymers

7	1MS19BBT07 PankajJ P Sajane	Dr. L. Sivarama Prasad & Dr. B. Reddaiah, Lead Scientist and Scientist AgriGenome Labs Pvt. Ltd. Hyderabad, Telangana State-10.	Molecular evaluation of rice (oryza sativa l) gremplasm for biotic and abiotic stress
8	1MS19BBT09 Sooryashankar R	Akash S, Senior Scientist, BIOPOL Biosciences, Bangalore Bioinnovation Centre (BBC), Helix Biotech Park, Electronic City phase 1, Bengaluru	Optimization and Production of polyhydroxybutyrate (PHB)
9	1MS19BBT10 Hanna Abdul Hakeem	Mr. Sharath Kumar LM Research scientist Department of Phytochemistry The Himalaya Drug Company Makali, Bengaluru	Integrated extraction approach for isolation of phytocompounds from Glycyrrhiza glabra (licorice) root: An opportunity in the application of skincare products
10	1MS18BBT08 Sheersha Sivadas	Dr Rakhi P Chief Technical Officer (CTO) Center for Brain Development and Research (CBDR) InStem, Bangalore.	“Study On Astrocyte Secretory Protein And Oxidative Stress In Fragile X Syndrome”
11	1MS18BBT09 Shivali Muthappa B	Mr. Sharath Kumar LM Research Scientist Department of Phytochemistry The Himalaya Drug Company, Makali, Bangalore	Isolation of natural allantoin from the tubers of Dioscorea bulbifera: A natural moisturising agent for skincare products

Academic experts in guiding major Projects

Sl.No	USN & Student Name	Experts from Research Institute	Title of the major project work
1	1MS20BBT04 Ayana EK	Dr. William R Surin Principal Research Scientist, Department of Microbiology and Cell Biology, Indian Institute of Science Bengaluru	Investigation the potential role of VAV3protein in platelate adhesion, activation and thrombus formation.
2	1MS20BBT10 Saba Anjum	Dr. William R Surin Principal Research Scientist Department of Microbiology & Cell Biology Indian Institute of Science Bengaluru	To study the collagen mediated inhibition of platelet activation by various inhibitors and anticoagulatory effects of phytochemicals.
3	1MS19BBT05 Kruthika I N	Mr. Basavanagowda M.G. Horticulture scientist, ICAR -Taralabalu krishi Kendra, Davangere.	Development of growth promoting bio stimulants using domestic wastes
4	1MS19BBT08 Raksha Rajagopal	Dr. N. Ravi Sundaresan Associate Professor, Department of Microbiology and Cell Biology Indian Institute of Science, Bengaluru	Association of SIRT1 single nucleotide polymorphisms with dilated cardiomyopathy in Indian population
5	1MS18BBT10 Sneha Judith	Dr. N Ravi Sundaresan Assistant Professor Department of Microbiology and Cell Biology Indian Institute of Science, Bengaluru	Understanding the effect of Nutrient Starvation on the biogenesis of lysomes in HELA cells

ICT supported learning

ICT supported learning:

Many faculty members of the department uses directly or indirectly use ICT tool for efficient teaching learning process

➢ ➢ Google meet/Google Classroom: Faculty utilize the Institute adopted commercial subscription of Google meet to conduct virtual classes. The video recording option enable students to have access to pre-recorded sessions. Google Classroom is used to streamline the process of sharing files between teachers and students, distributing, and grading assignments.

➢ Zoom communication: Alternatively Zoom communication platform have been used by the faculty members of the department for an efficient teaching learning process.

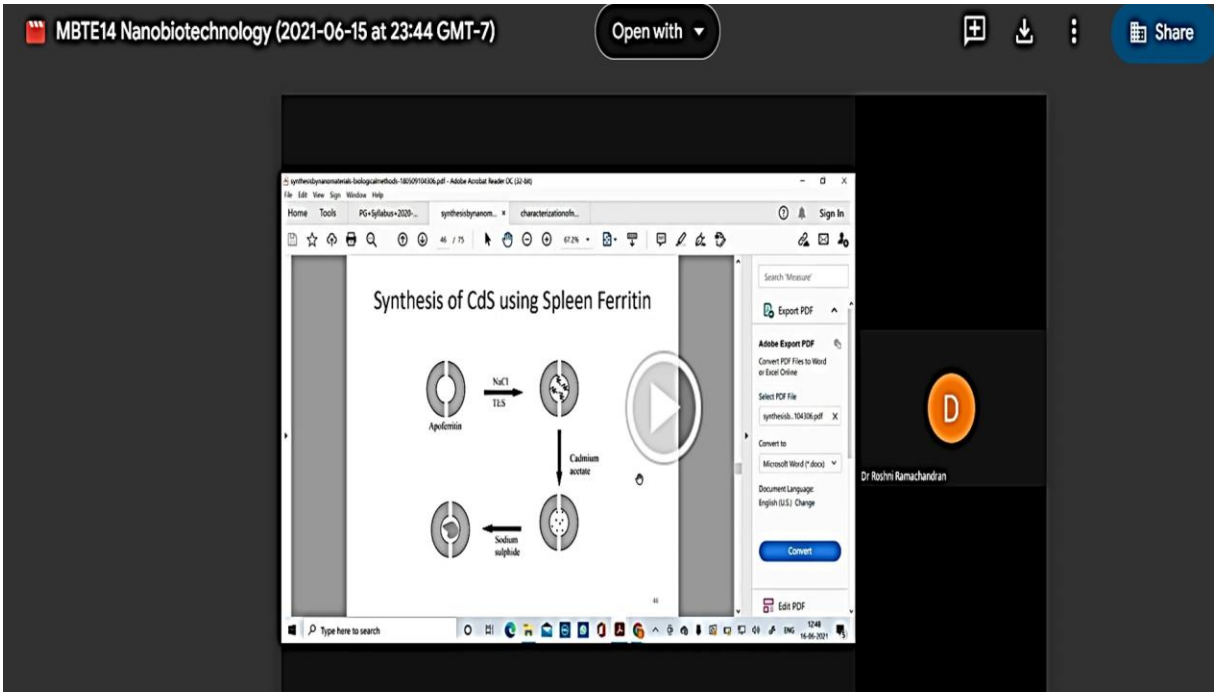
➢ Edmodo: Edmodo is an online tool with several user-friendly options such as sharing and review of course contents, assignments etc. Faculty members use this platform for conduction on online test, quiz and evaluation of student performance

➢ Impartus: The Institute subscribes to Impartus, which provides a large database on recorded videos of for students online review purposes.

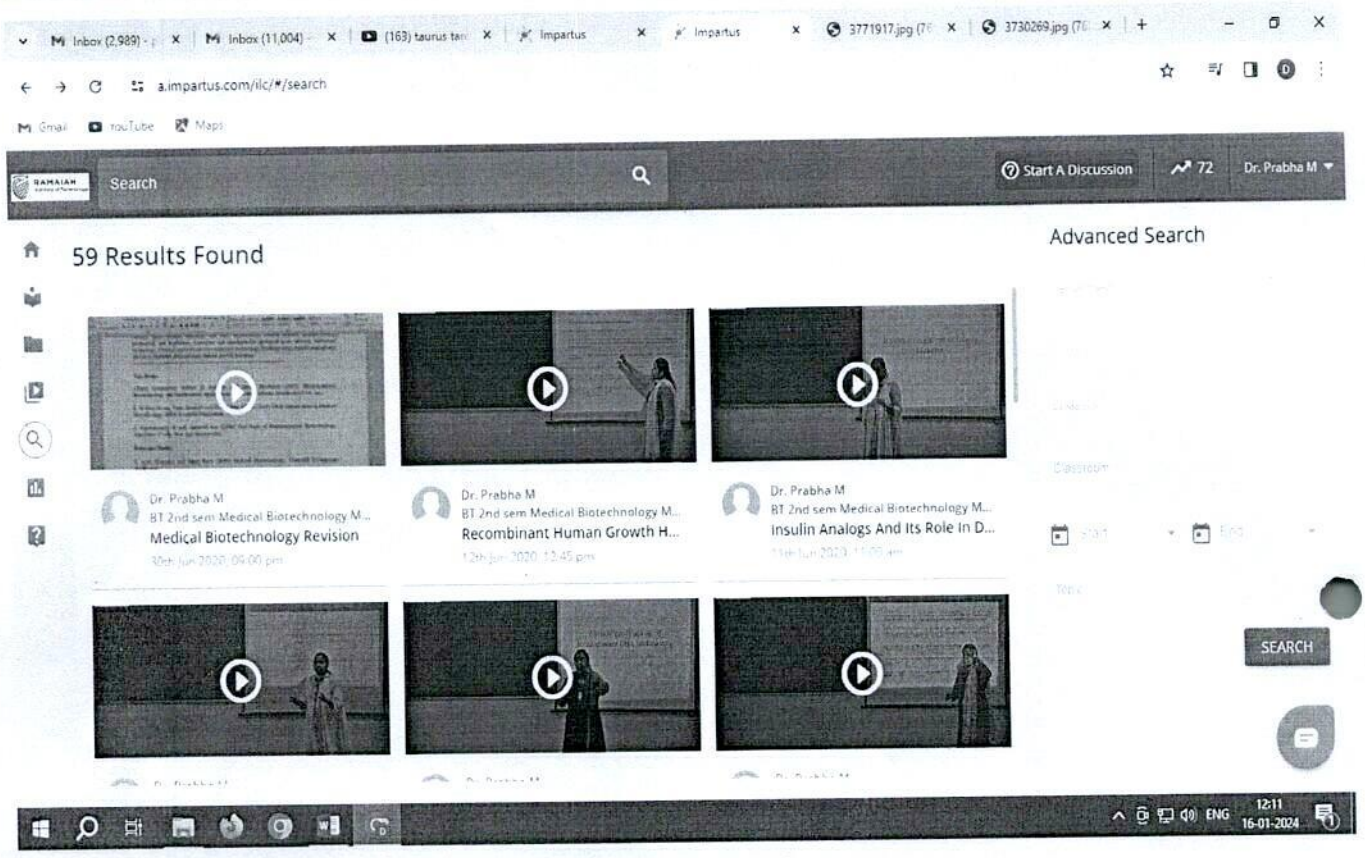
➢ YouTube channel: Few faculty members are actively involved in course material development for MTech subjects and reposited on YouTube channel

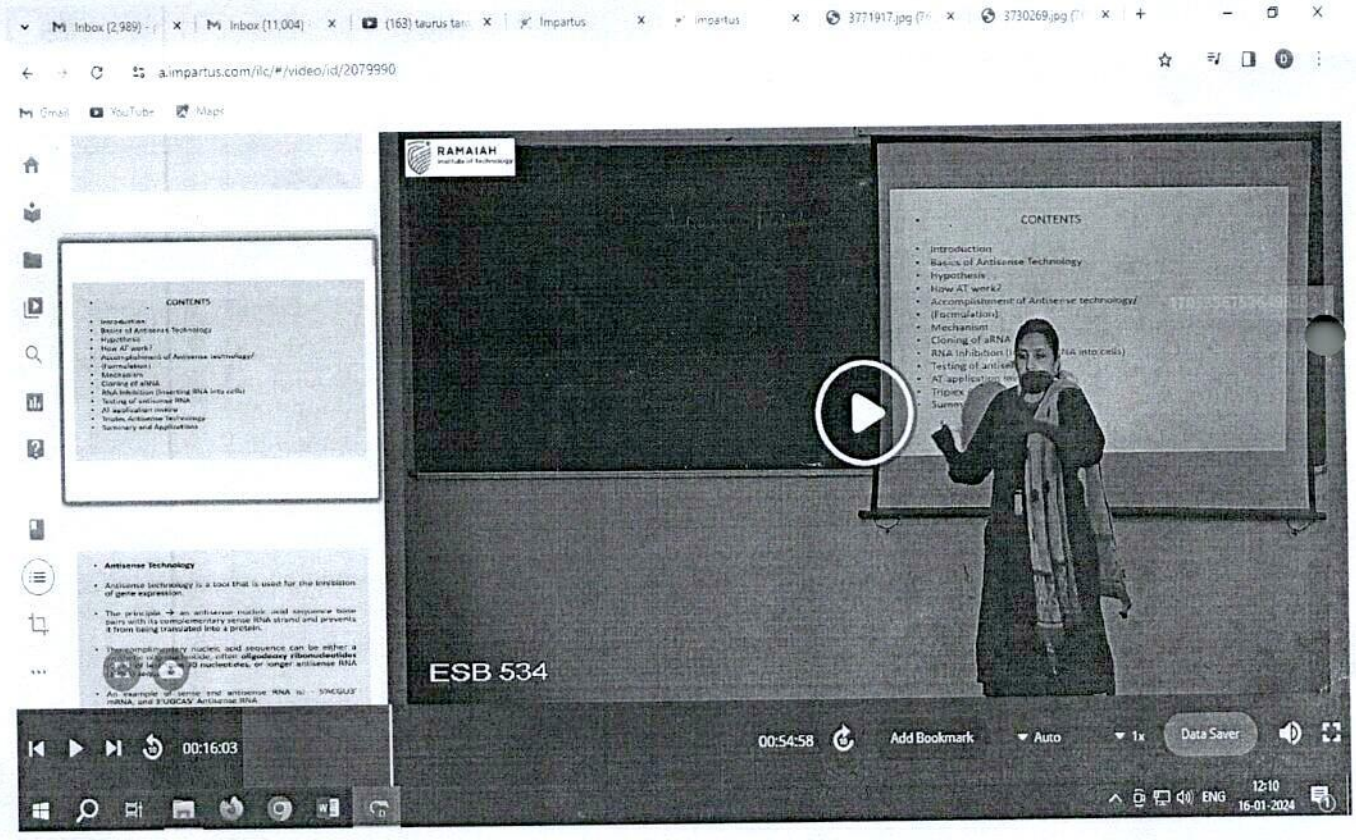
Teaching learning process during pandemic : Online teaching

MBTE14 NanoBT
Tuesday, June 22, 2021 · 12:10 – 1:10pm
Time zone: Asia/Kolkata
Google Meet joining info
Video call link: https://meet.google.com/rff-vwzs-pro
Or dial: (US) +1 419-684-2332 PIN: 806 462 046#



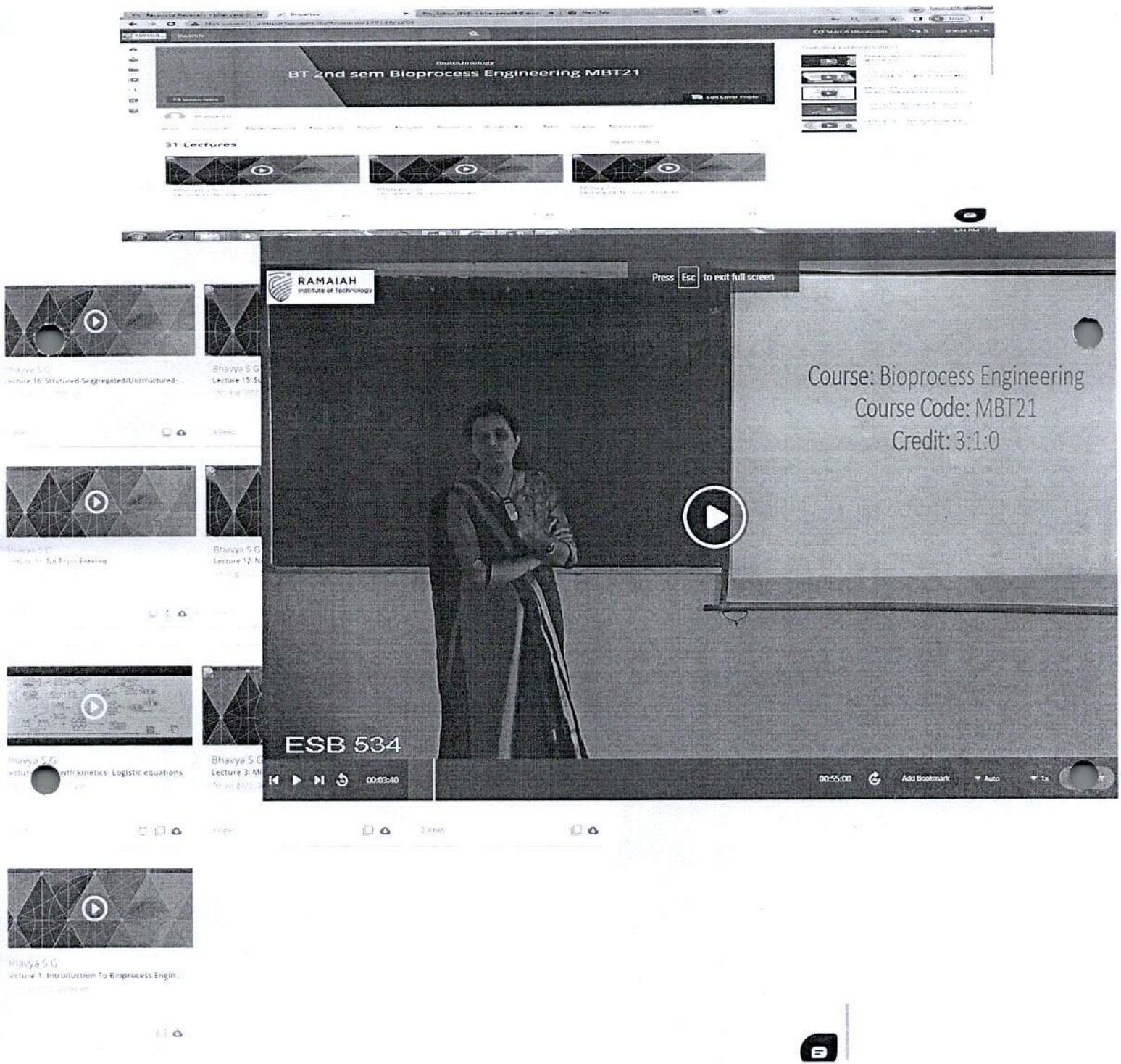
MBTE04 Medical Biotechnology [MTech II Semester] Imparts video clips





Impartus Lecture recording for the course

Bioprocess Engineering- MBT21



Virtual Labs for Bioprocess Engineering course

Virtual Labs — An MoE Govt of India Initiative

Sakshat Virtual Labs

भारतीय प्रौद्योगिकी संस्थान दिल्ली
Indian Institute of Technology Delhi

Home >> Biotechnology and Biomedical Engineering >> Bioreactor Modeling and Simulation Lab

Bioreactor Modeling and Simulation Lab

List of experiments

1. Bioreactor- Basics
2. Control Characteristics of pH Controller
3. Estimation of growth kinetic parameters in batch fermentation
4. Simultaneous measurement of specific growth/death rate of micro organisms
5. Determination of Volumeteric Mass Transfer Co-efficient (Dynamic method)
6. Determination of Volumeteric Mass Transfer Co-efficient (Oxygen balance method)
7. Development of mathematical model
8. Batch Microbial Cultivation
9. Fed-Batch Microbial Cultivation
10. Continuous Microbial Cultivation
11. Biopolymer Production by Microbes
12. Acetone-Butanol-Ethanol Fermentation
13. Propionic Acid Fermentation
14. 1, 3 Propanediol Fermentation

Virtual Labs — An MoE Govt of India Initiative

Sakshat Virtual Labs

भारतीय प्रौद्योगिकी संस्थान दिल्ली
Indian Institute of Technology Delhi

Study of Enzyme Kinetics

Home | Theory | Procedure | video | Self Evaluation | References

Objective: Study of the enzyme kinetics for saccharification of starch using amylase enzyme.

Theory: Reaction of enzyme and substrate follows Michaeli's Menten kinetics and is a two step reaction. In the first phase of reaction Enzyme (E) reacts with Substrate (S) to form ES (Enzyme-Substrate complex). This reaction is relatively fast and reversible in nature. The ES complex is, thereafter, decomposed to form product and enzyme is released. The above reactions can be written as follows –

$$E + S \rightleftharpoons ES$$

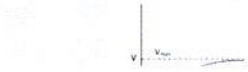
$$ES \longrightarrow P + E$$

The velocity (V) of above reaction is measured by rate of decomposition of 'ES' complex which is a slower reaction amongst the two reactions (1 & 2) described above. Velocity 'V' can be theoretically described by Michaeli's Menten equation as shown below -

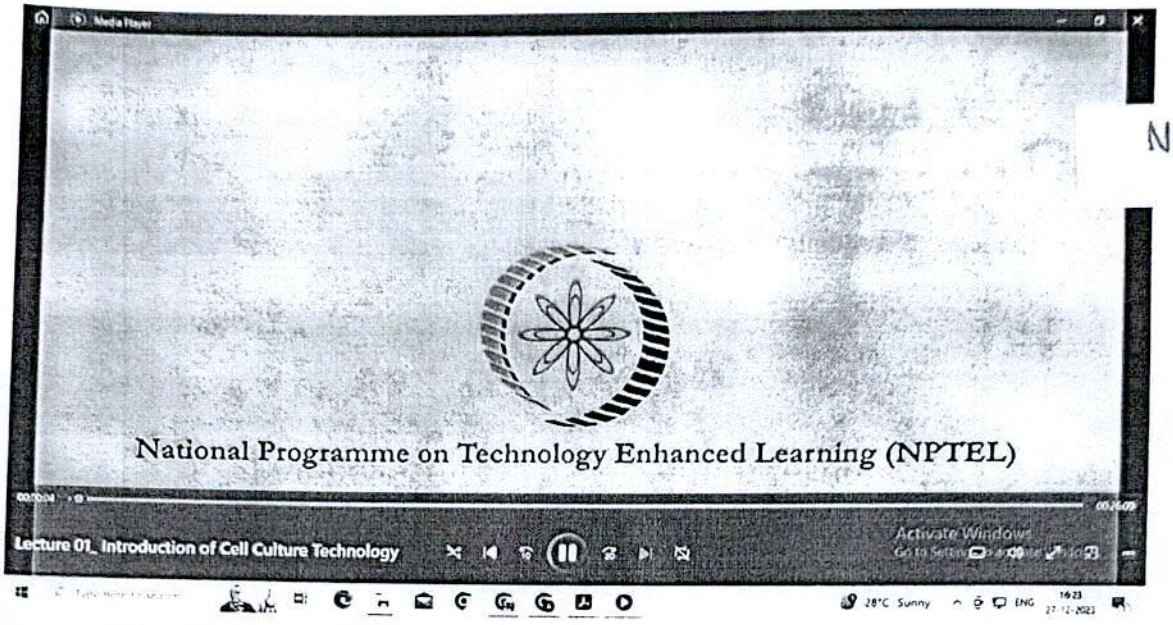
$$V = Vmax\ S / (Km + S)$$

Where, V = Reaction velocity
Vmax = Maximum velocity of Enzyme Substrate reaction
S = Concentration of substrate
Km = Michaelis – Menten constant

The velocity of the reaction is experimentally measured by the measurement of rate of either the disappearance of substrate (ds/dt) or appearance of product (dp/dt). The variation of velocity of enzyme substrate reaction can be studied experimentally. For Michaeli's Menten Kinetics the nature of 'V' vs 'S' plot appears as shown below –



NPTEL video lectures on Cell culture technologies



Novel Tec
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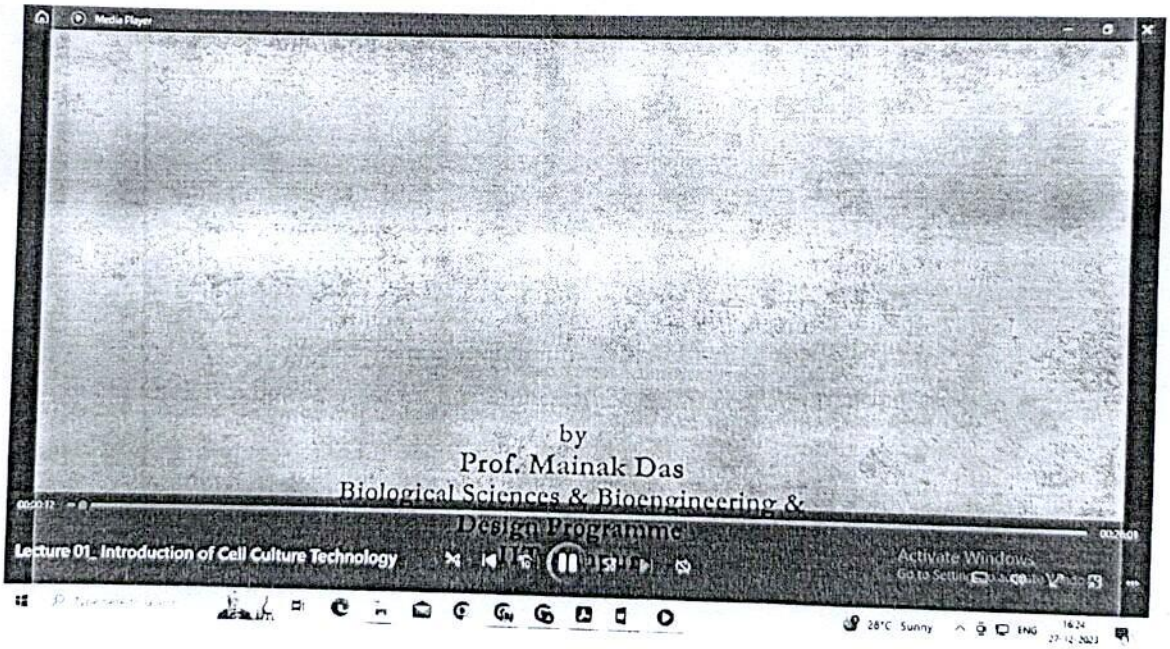


Tutorial-2

Exploring the tools and databases available for strain improvement

In the ever-evolving landscape of biotechnology, the quest for optimizing microbial strains for enhanced performance is at the forefront of scientific innovation. Strain improvement, a pivotal aspect of fields like metabolic engineering and synthetic biology, relies on a diverse array of sophisticated tools and comprehensive databases. These resources serve as the backbone for researchers, offering insights into the intricate molecular machinery of living organisms and providing avenues for precision manipulation. Some of the tools and databases for various aspects of strain improvement are as follows: Certainly, here's the list with the format you requested:

1. Biological Databases:
- KEGG: https://www.genome.jp/kegg/
- BioCyc: https://biocyc.org/

2. Metabolic Engineering Tools:
- COBRA Toolbox: https://opencobra.github.io/cobratoolbox/stable/
- OptFlux: http://optflux.org/

3. Synthetic Biology Tools:
- MODOMICS: https://iimcb.genesilico.pl/modomics/
- iGEM Registry of Standard Biological Parts: http://parts.igem.org/Main_Page

4. CRISPR-Based Tools:
- CHOPCHOP: https://chopchop.cbu.uib.no/

5. Genome Editing Tools:
- Zinc Finger Nucleases (ZFNs): https://www.sangamo.com/pipeline/zinc-finger-nuclease-technology
- TALENs (Transcription Activator-Like Effector Nucleases): https://www.cellectis.com/talens/

6. Omics Databases:
- NCBI GenBank: https://www.ncbi.nlm.nih.gov/genbank/
- Protein Data Bank (PDB): https://www.rcsb.org/

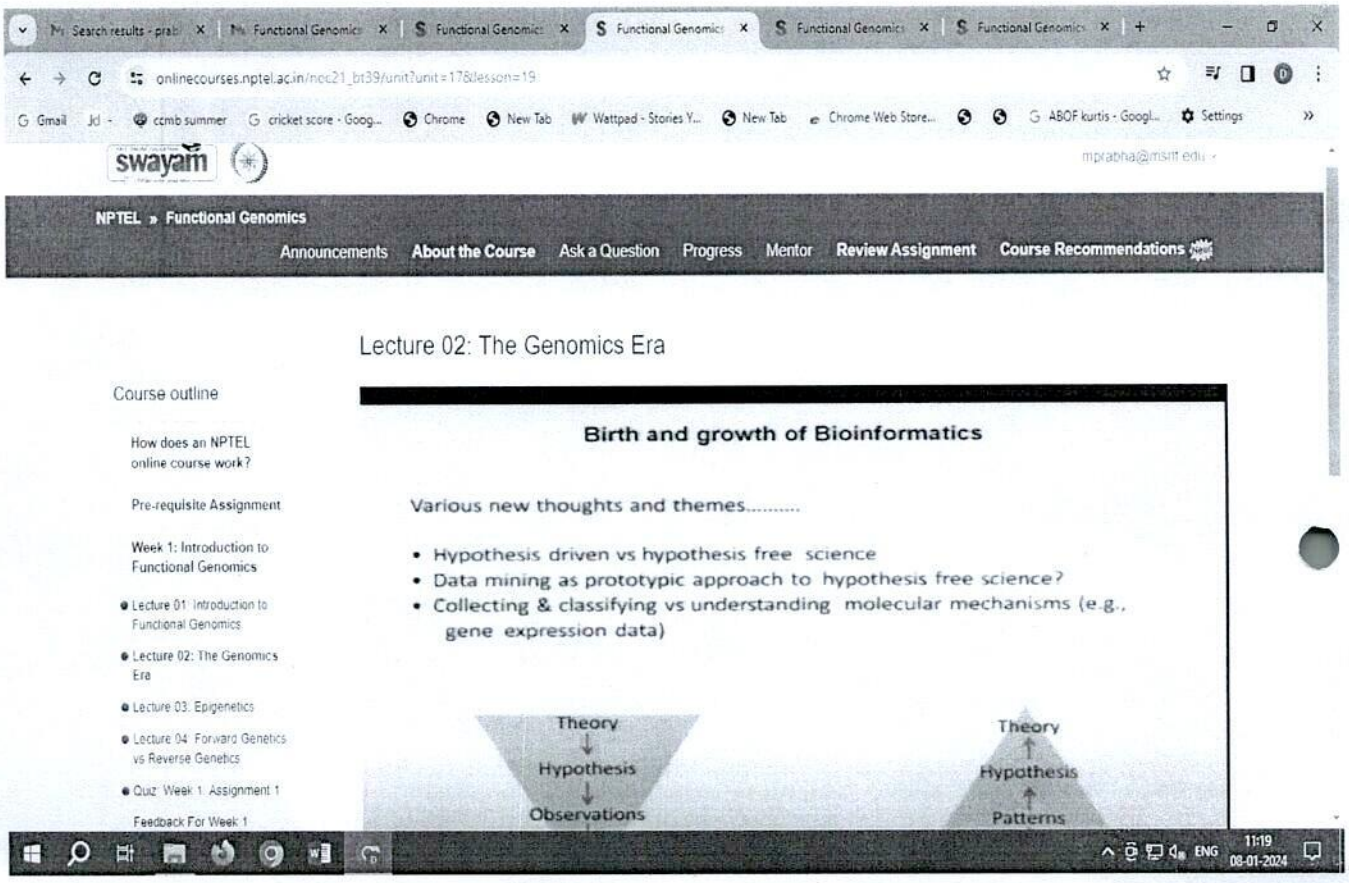
7. Pathway Analysis Tools:
- Pathway Tools: https://bioinformatics.ai.sri.com/ptools/
- MetExplore: http://metexplore.toulouse.inra.fr/

8. Strain Design and Simulation:
- Cello: https://github.com/CIDARLAB/cello
- CellNetAnalyzer: https://www.mpi-magdeburg.mpg.de/projects/cna/cna.html

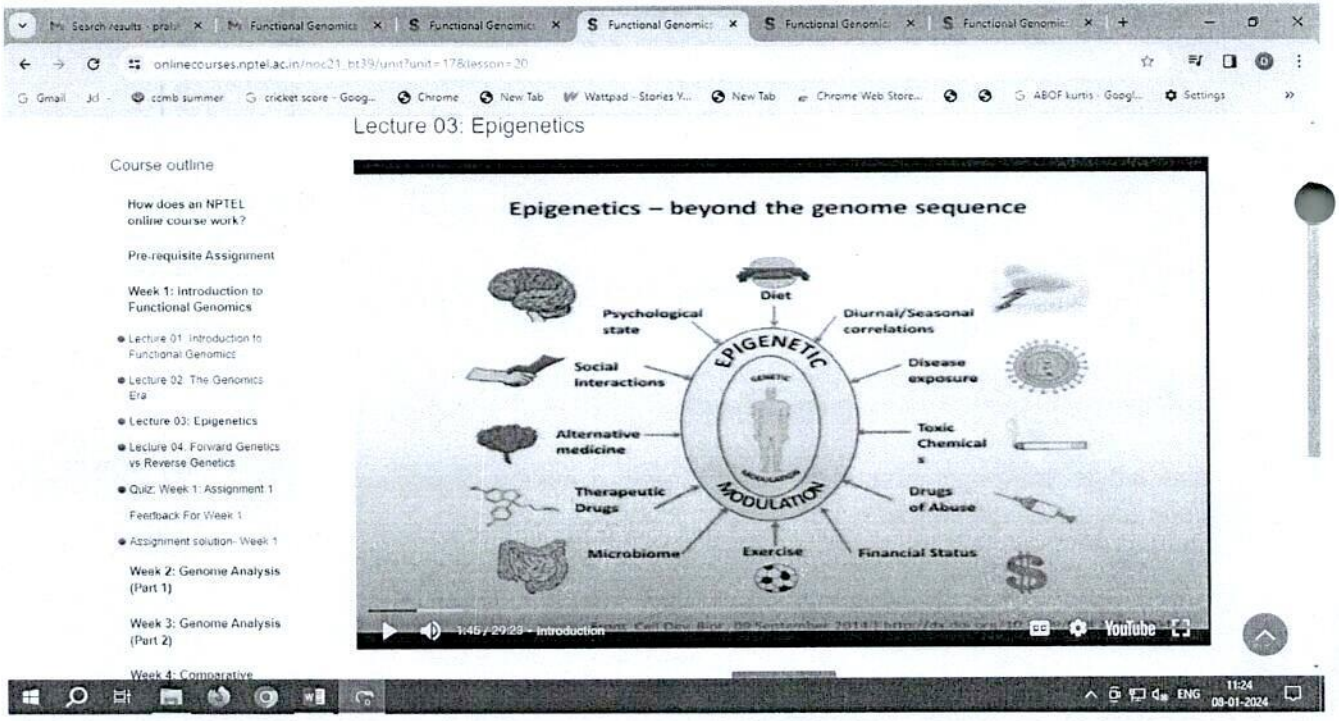
9. CRISPR Activation and Repression Tools:
- Synergistic Activation Mediator (SAM) System: https://www.addgene.org/crispr/pdz/sam/

Adoptation of NPTEL course for course delivery.

Functional Genomics NPTEL course [selected slides for Protein engineering & Industrial Applications]

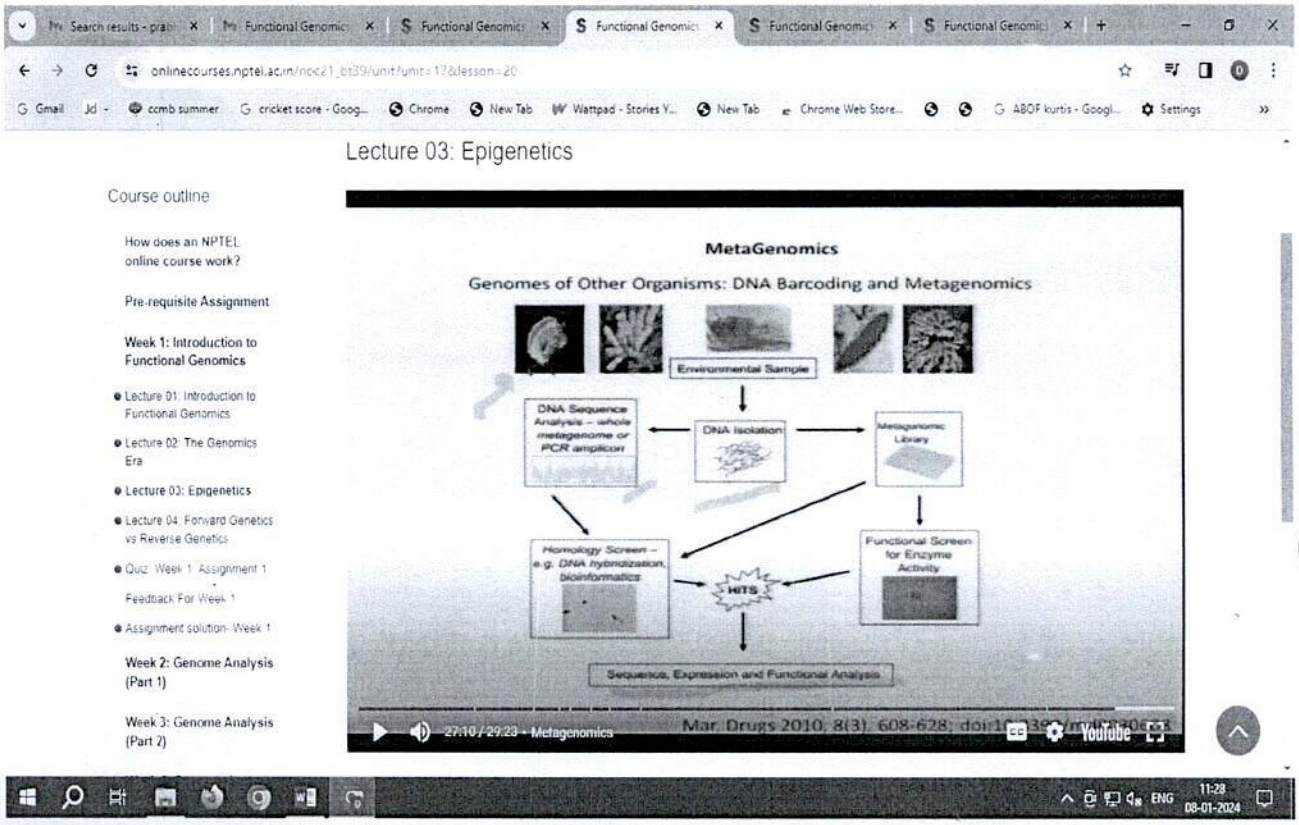


1.NPTEL sample slide showing the link to Bioinformatics and Genomics

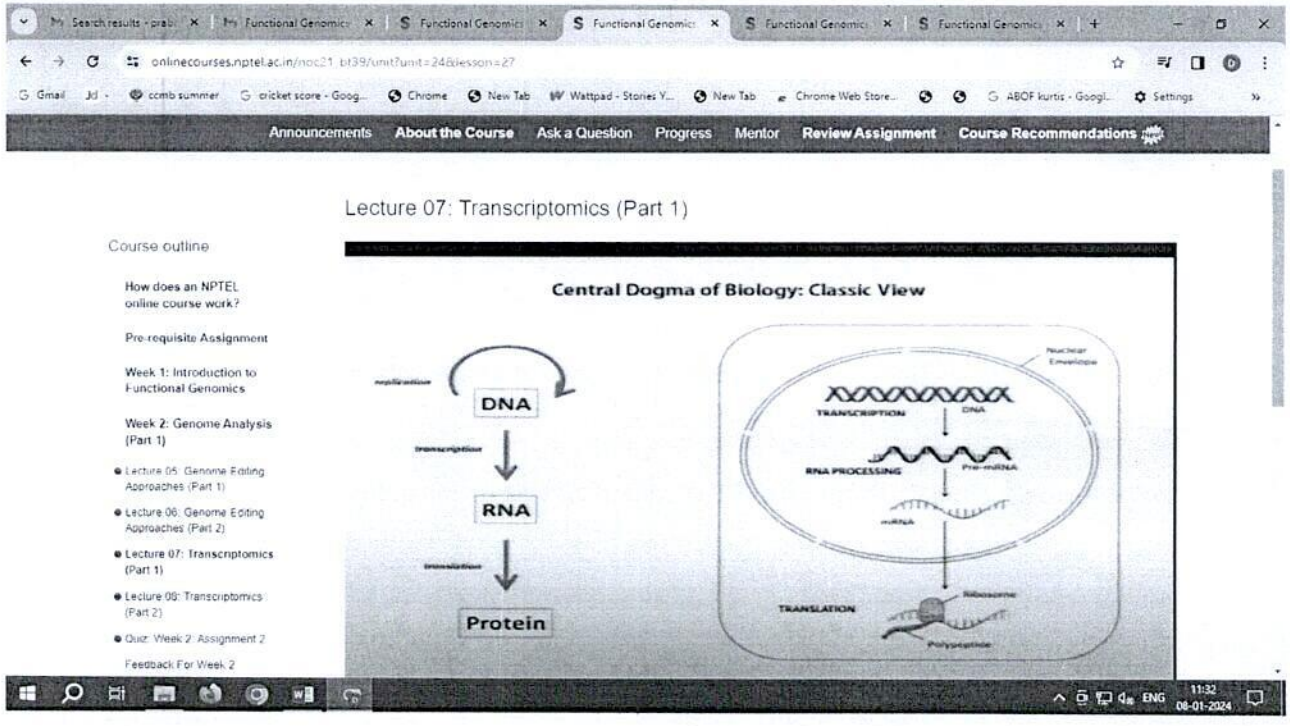


2. NPTEL sample slide showing the link to genome sequence and applications

Functional Genomics NPTEL course [selected slides for Protein engineering & Industrial Applications]



3. NPTEL sample slide showing the link to Metagenomics to Enzyme activity, Sequence expression and functional analysis with Bioinformatics tools



4. NPTEL sample slide Transcript omics showing the link to Central dogma of Biology→ DNA→ RNA→ Protein

Experiential Learning

Course Code: MBT21
Credit: 3:1:0

Course: Industrial Biotechnology
Maximum Marks: 05

Experiential learning is a pivotal component of the MBT21: Industrial Biotechnology course, offering students a unique blend of hands-on training and real-world exposure. This dynamic learning approach was exemplified through a structured program that began with a technical workshop on industrial bioreactors, followed by an enlightening industrial visit to Biozeen, a leader in the biotechnology sector.

The course commenced with a comprehensive workshop focused on industrial bioreactors, a cornerstone in biotechnological manufacturing. This workshop provided students with critical hands-on experience, enabling them to engage directly with the equipment and technologies that drive biotechnological processes. Students gained practical knowledge in the operation, control, and troubleshooting of bioreactors. Emphasis was placed on understanding the intricacies of scaling up laboratory processes to industrial levels, a vital skill in biotechnology.

Building on the foundational knowledge acquired in the workshop, the course then transitioned to an industrial visit to Biozeen. This visit served as a practical extension of the workshop, allowing students to see the real-world application of their newly acquired skills. At Biozeen, students were exposed to the operational complexities of a functioning biotechnology company. They observed how theoretical principles are applied in industrial settings and gained insights into the production, quality control, and regulatory aspects of the biotechnology industry.

This combination of a hands-on workshop followed by an industrial visit provided a comprehensive learning experience in MBT21: Industrial Biotechnology. By first grounding students in the technical aspects of bioreactors and then showcasing their application in an industrial context, the course effectively bridged the gap between theory and practice. This approach not only enhanced the students' understanding of biotechnological processes but also prepared them to meet the challenges of a career in this rapidly advancing field.

Teaching Methods and Pedagogical Initiatives

Teaching Methods

- Blackboard Teaching
- Tutorials
- PPT Presentations/Multimedia Demonstrations
- Hands-on demonstration of modern tools
- Industry involvement (Partial delivery of course, Expert Lectures)

Pedagogical Initiatives

Experiential Learning

- Mini-Projects
- Modern tools (Workshops/Industry visits)

ICT Supported Learning

- Impartus Lecture Recording
- Google Classroom
- Course Material on Website

Participative Learning

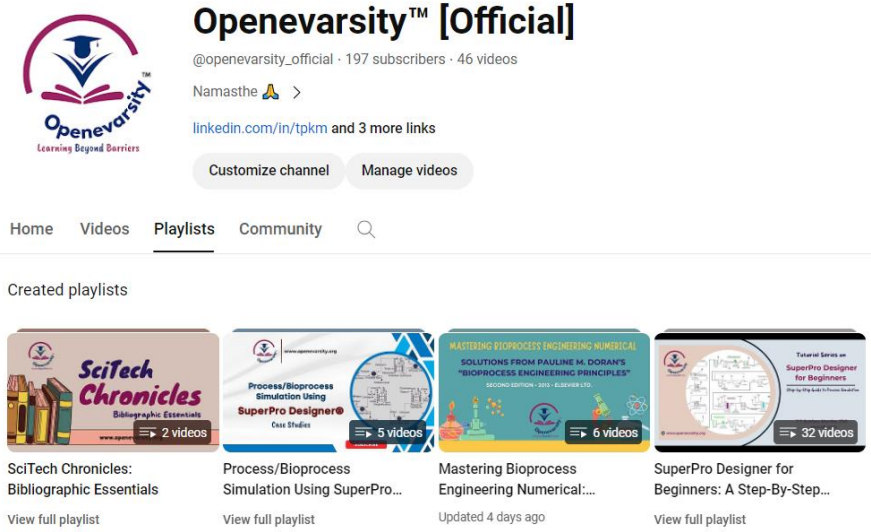
- Case study analysis and discussion

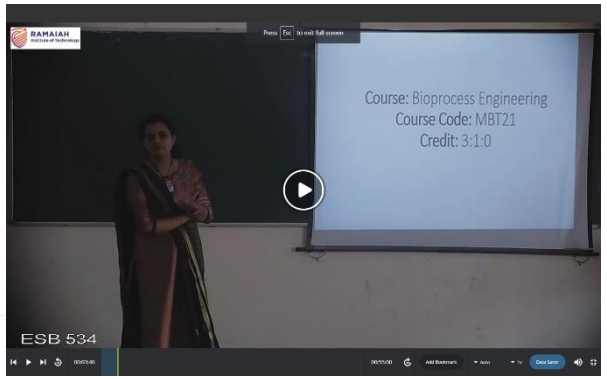
Problem Solving Methodologies

- Tutorial Sessions

Innovative Teaching Learning– Course Delivery

Course content developed for MBT21





Impartus Video Lecture Recording

Courses Recorded

- Medical Biotechnology (MBTE03)
- Bioprocess Engineering (MBT21)
- Advanced Molecular Biology and Genetic Engineering (MBT11)
- Biopharmaceutical Technology (MBT22)

E-content developed for Theory Courses

Programme: M.Tech. Biotechnology (Semester-II)

Course Code	Course	Link
MBT21	Bioprocess Engineering	Click here
MBT22	Biopharmaceutical Technology	Click here
MBTE04	Medical Biotechnology	Click here
MBTE10	Applied Animal Biotechnology	Click here
MBTE11	Bioanalytical and Biophysical Techniques	Click here

Recorded Laboratory Courses

Programme: M.Tech. Biotechnology

Semester-II			
Course Code	**Course**	**List of Experiments**	**Link**
MBT L23	Bioprocess Modelling and Simulation Lab	1. MATLAB for bioprocess engineering applications 2. Linear and nonlinear regression analysis of mathematical models 3. Screening of significant process parameters by factorial and Plackett-Burman designs using Microsoft Excel and Design Expert 4. Optimisation of process parameters by Response Surface Methodology (RSM) using Microsoft Excel and Design Expert 5. Development of bioprocess flow sheets using SuperPro Designer 6. Simulation of biofuel/bioproducts production plant using SuperPro Designer 7. Simulation of Biopharmaceutical production using SuperPro Designer 8. Literature collection, preparation of research data, professional writing of research paper and reference management 9. Report/Thesis writing and reference management using LaTeX software	Click here
MBT L24	Biopharmaceutical Technology Lab	1. Handling and working principles of dissolution test apparatus 2. Dot ELISA 3. Standardization of herbal drugs by TLC method 4. Determination of partition coefficient of given drugs 5. Preparation of controlled release formulation of amylase 6. Validation of autoclave using biological indicators 7. Freeze drying process	click here

Innovative Teaching Learning– Course Delivery

Use of Virtual Lab Content

Virtual Lab tool assessment Test

DEPARTMENT OF BIOTECHNOLOGY		
Ramaiah Institute of Technology, Bangalore-560054 (An Autonomous Institute Affiliated to VTU, Belgaum)		
Continuous Internal Evaluation- Other component Assessment		
Course & Branch: M.Tech - Biotechnology	**Semester** : II	**Term:** 23-06-23 to 23-09-2023
Subject: Bioprocess Engineering	**Maximum Marks :** 10	**Test Date:** 04-09-2023
Subject Code: MBTE232		**Credits:** 3:0:0:0

Sl. #	Virtual Lab topic: Process Economics and Cost estimation analysis of various bioprocess products using Superpro Designer	Blooms Level	Marks
1	**Introduction to the selected product and the Superpro designer tool** Introducing the product selected and the Brief outline about its significance Introducing the tool used to build the production flow chart	L1 L2	02
2	**Production Flowchart** : Design the production flow chart of the selected product using Superpro designer and attach the obtained flow chart	L3	02
3	**Cost estimation /market analysis:** Tabulate the cost estimation of the product and discuss the details of each component with pie chart.	L4	06

Partial Delivery by Industry Experts

Partial delivery by Industry expert from Syngene for MBT232.

Partial delivery topics assessment

DEPARTMENT OF BIOTECHNOLOGY		
Ramaiah Institute of Technology, Bangalore-560054 (An Autonomous Institute Affiliated to VTU, Belgaum)		
Continuous Internal Evaluation- Other component Assignment		
Course & Branch: M.Tech.- Biotechnology	**Semester** : II	**Term:** 23-06-23 to 23-09-2023
Subject: Bioprocess Engineering	**Maximum Marks :** 10	**Test Date:** 14-09-2023
Subject Code: MBTE232		**Credits:** 3:0:0:0

Sl. #	Answer any two of the following	Blooms Level	Marks
1	Explain the criteria to be considered for bioreactors.	L2	05
2	Discuss the entire flow sheet of human insulin production. Use a neat process flow diagram to explain the complete process.	L3	05
3	Discuss the rules to be followed for scale down studies in bioprocessing.	L2	05
4	Explain the various considerations for the design of scaling down of bioreactors.	L3	05

Innovative Teaching Learning– Course Assessment

Case study Analysis

Guidelines

1. **Case Study Selection:**
   - Choose an example file from the ones provided with SuperPro Designer software.
   - Ensure that the selected case study is relevant to your field of study or interest.

2. **Review Articles:**
   - Select 3 to 5 peer-reviewed articles published in reputable journals.
   - These articles should be closely related to the chosen example.
   - Summarize the key findings and relate them to your case study.

3. **Oral Presentation:**
   - Prepare an oral presentation based on the chosen case study and review articles.
   - Do not use PowerPoint or any other slide-based tool.
   - Focus on explaining the methodology, findings, and relevance of the case study.

4. **Submission Requirements:**
   - Submit the example file from SuperPro Designer that you worked on.
   - Provide hard copies of the selected review articles with your key annotations or notes.
   - Ensure all submissions are clearly labeled with your name and student ID.

Rubrics for Evaluation

Criteria	Level 3 (Exemplary)	Level 2 (Proficient)	Level 1 (Basic)	Marks
1. Understanding of the Case Study	In-depth understanding, broad connections	Good grasp, minor misunderstandings	Limited understanding, significant gaps	1 Marks
2. Integration of Review Articles	Effective integration, insightful analysis	Adequate integration, some analysis	Minimal or superficial integration	1 Marks
3. Presentation Skills and Submission	Clear, confident, engaging presentation	Structured presentation, minor issues	Unclear, disorganized presentation	3 Marks

Experiential Learning Assessment

Technical Workshop

Industry Visit

RAMAIAH Institute of Technology | Department of BIOTECHNOLOGY

USN	1	M	S	2	2	B	B	T		
Name										

Continuous Internal Assessment

Programme: Master of Technology-Biotechnology

Semester: II **Course Name:** Industrial Biotechnology **Course Code:** MBT21

CIE: Quiz Based on Industrial Visit and Technical Workshop

Integrating Multimedia Learning Resources in Teaching

Course: Industrial Biotechnology
Credits: 3:1:0

Course Code: MBT21
Term: 26.06.2023 to 23.09.2023

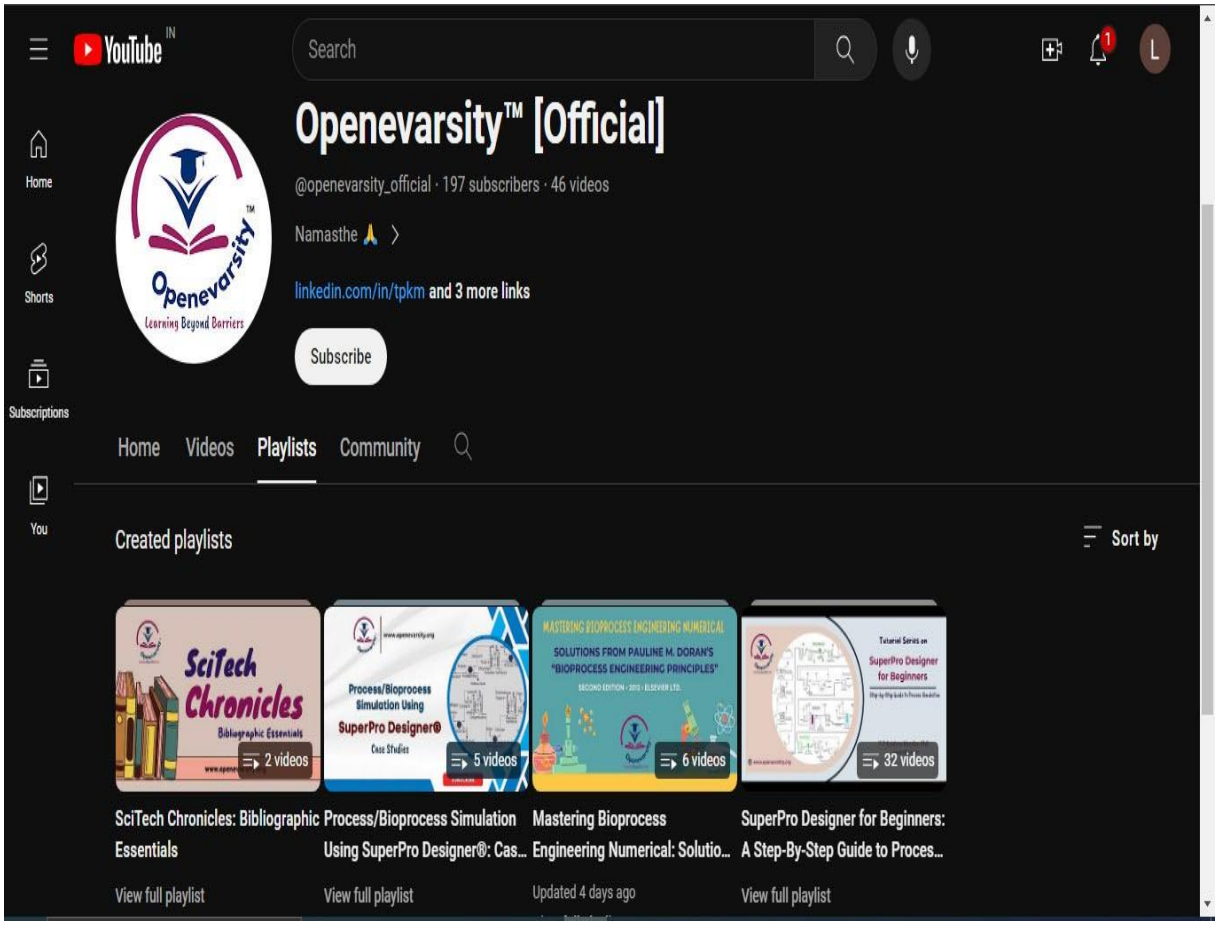
Purpose:

The primary goal of developing YouTube videos is to facilitate the learning and understanding of SuperPro Designer® for students enrolled in the MTech Biotechnology program. Recognising the pivotal role that process simulation software plays in modern biotechnology, this video seeks to demystify SuperPro Designer®, making it accessible and understandable, particularly for students who are new to this type of software.

SuperPro Designer® is an integral tool in the field of Industrial Biotechnology, offering capabilities that range from process simulation to cost analysis and environmental impact assessments. For students aspiring to excel in this dynamic field, proficiency in such a tool is not just an asset; it's a necessity. *These instructional YouTube videos aim to bridge the gap between theoretical knowledge and practical application, providing students with a solid foundation in SuperPro Designer®.*

By presenting a comprehensive overview, from basic functionalities to advanced applications, these videos are designed to not only introduce students to the software but also to deepen their understanding of its potential applications in various biotechnological processes. Through this endeavour, the aim is to equip students with the skills and knowledge necessary to effectively utilize SuperPro Designer® in their academic and future professional pursuits, thereby enhancing their competency and preparedness for the challenges and opportunities in the field of Industrial Biotechnology.

YouTube Channels



FEED BACK SYSTEM

➢As a part of innovative teaching learning process efficient feedback system enables the faculty at Department of Biotechnology to amend or improvise the existing teaching learning process.

➢The feedback received through the stakeholders like employers, alumni, parents, industry experts, researchers in academia enhances the teaching learning process and contributes to improving the curriculum. ➢The following links are used for to amend or to improve the existing OBE.

Feedback link	Semester
Alumni Survey:	https://forms.gle/Lo2vu5ypQqpZqins5
Parents Survey:	https://forms.gle/qPgzoLPiivMwURwVA
Graduate Survey/Student Survey:	https://forms.gle/9ftiFi5hasSADJ5m9
Virtual Lab (BTL48):	https://forms.gle/CMvUzHuWA9qvSjhU6
Employers Survey:	https://forms.gle/1YvPgoTDuZwURkyk9