DEPARTMENT OF BIOTECHNOLOGY,

KLE TECHNOLOGICAL UNIVERSITY, HUBBALLI - 31

Program: Biotechnology		
Course Title: Bioprocess Control and Automation		**Course Code:15EBTC307**
L-T-P: 3-0.5-0	**Credits: 3.5**	**Contact Hours: 3 hours/week**
CIE Marks:50	**SEE Marks:50**	**Total Marks:100**
Teaching Hours:40	**Examination Duration:3 hrs**	

Unit I

1 Instrumentation & Process Dynamics: Introduction to Measurement of important physicochemical and biochemical parameters in bioprocess. Methods of on line and off line estimation of biomass, substrates and products. Brief introduction to typical automatic control system and its components. Open loop and closed loop control systems. **05 Hours**

2 First & Second Order Systems: Mathematical representation of physical systems. Transfer function representation of linear first order systems, Examples: mercury in glass thermometer & Liquid level system. Mathematical forms of standard Input function/Forcing Functions such as Step input, Impulse Input, Linearly increasing Input and Sinusoidal Input. Response of first order system for step input, Features of step response, Response of linearly increasing input. Conceptual numerical. First Order Systems in Series: Interacting and Non-Interacting systems & their Transfer function representation. Second Order Systems: Transfer function representation of Second order systems, Example: Pneumatic Control Valve. **10 Hours**

Unit II

3 Controller and Final Control Elements: Different types of controllers-P (Special case of P-controller i.e ON-OFF controller), PI, PD, PID controllers. Derivation of Transfer Functions of different types of controllers. Final control element: The role of Final control Element in control system. Example: Pneumatic Control Valve: Working of Pneumatic control valve, Types of Pneumatic Control Valves i.e. Air to close & air to open. **08 Hours**

4 Block Diagram Reduction: Block diagram representation of control systems, Block diagram reduction in case of Servo and Regulatory control systems. Reduction of block diagrams for single input & Single output systems (SISO) & Multiple Input & Multiple Output Systems (MIMO), Problems on block diagram reduction. **07 Hours**

Unit III

5 Transient response of different controllers for Servo & Regulatory control Problems: Transient response of P, PI, PD & PID controllers for servo and regulatory problems. The determination of offset in all cases. **05 Hours**

6 Analysis of Stability: Concept of stability, stability criterion. Routh test for stability. Theorems of Routh Array test, Conceptual numerical on Routh test for stability. **05 hours**

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Course Feedback

(To be filled by each Student at the time of Course Completion)

Dear Students,

Please give us your views on this Course so that the course quality can be improved. You are encouraged to be frank and constructive in your comments.

Course Teacher

Department/School Biotechnology Name of the Teacher Dr. L. R. Patil

Course Title Bioprocess Control and automation Course code: 15EBTC307 Semester VI

a. The design of the course	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
The course objectives were clear		✓			
The course contents met with your expectation		✓			
The course work load was manageable	✓	✓			
The lecture sequence was well planned to meet learning outcomes	✓				
The contents were illustrated with adequate examples		✓			
The course exposed you to new knowledge and practice		✓			
The level of the course was moderate	✓				

b. The conduct of the course	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
The lectures were easy to understand & ideas and concepts presented clearly		✓			
The teaching aids were effectively used		✓			
The course material handed out was adequate	✓				
Were objectives of the course realized?		✓			
The overall environment in the class was conducive to learning	✓				

c. Learning Resources	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
Learning materials (Lesson Plans, Course Notes etc.) were relevant and useful		✓			
Recommended reading Books etc. were relevant and appropriate		✓			
The provision of learning resources in the library was adequate and appropriate		✓			

d. Assessment	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
The method of assessment were reasonable		✓			
Feedback on ISA assessment was timely		✓			
Feedback on ISA assessment was helpful		✓			

Suggestions for improvement:

Overall rating of the course: (√tick mark the appropriate)

90% -100% ☐ 80% - 90% ☑ 70% - 80% ☐ 60% - 70% ☐ 60% - 50% ☐ Below 50% ☐

Date: Dec 2018

Signature

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Course Teacher Prof. L. R. Patil

Department/School Biotechnology Name of the Teacher _____

Course Title Bioprocess control & Automation Course code: BETC307 Semester VI

a. The design of the course	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
The course objectives were clear	✓				
The course contents met with your expectation		✓			
The course work load was manageable	✓				
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The contents were illustrated with adequate examples	✓				
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Course Teacher Prof L R Patil

Department ~~School~~ Biotechnology Name of the Teacher Prof L R Patil

Course Title Process Control & Instrumentation Course code: 15BTC307 Semester VI

a. The design of the course	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
The course objectives were clear		✓			
The course contents met with your expectation		✓			
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Employers Feedback form

Dear Sir/Madam,

We seek your kind participation in this process of collecting feedback about our graduates serving in your organization. Your inputs will be helping us to make required modifications in the existing curriculum, pedagogy to enhance the competencies of the graduating engineers.For each question, indicate your opinion with a tick mark in the appropriate column. All individual responses will be kept confidential. Only statistically analyzed results from the entire population will be shared.

Regards,

Head of the department

Please rank the following qualities:5 = excellent, **4** = high, **3** = good, **2** = average,**1** = low, NA= Not Applicable

S.No.	Qualities	1	2	3	4	5	NA
1	Ability to apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization for the solution of engineering problems	☐	☐	3	☐	☐	
2	Ability to identify, characterize and formulate a solution plan for solving engineering problems	☐	☐	3	☐	☐	
3	Ability to execute a solution process and analyze results	☐	☐	☐	4	☐	
4	Ability to design components, systems or processes that meet specified needs, following appropriate engineering design process	☐	☐	3	☐	☐	
5	Ability to conduct investigations or tests through design of experiments to understand and solve engineering problems	☐	☐	☐	4	☐	
6	Ability to critically analyse and interpret data to reach valid conclusions	☐	☐	☐	4	☐	
7	Ability to identify / create and use appropriate modern engineering and IT tools, techniques and resources to solve engineering problems	☐	☐	3	☐	☐	
8	Demonstrate an understanding of professional engineering regulations, legislation and standards	☐	☐	3	☐	☐	
9	Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development	☐	☐	☐	4	☐	

10	Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	☐	☐	☐	4	☐	
	Qualities	1	2	3	4	5	NA
11	Ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	☐	☐	☐	4	☐	
12	Ability to comprehend technical literature and prepare effective reports and design documents	☐	☐	☐	4	☐	
13	Demonstrate competence in listening, speaking, and presentation	☐	☐	3	☐	☐	
14	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	☐	☐	3	☐	☐	
15	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	☐	☐	3	☐	☐	
16	Ability to demonstrate adequate proficiency of good laboratory practices (GLP) in terms of accuracy & precision, safety, ethics and reproducibility and able to follow standard operating procedures (SOP).	☐	☐	3	☐	☐	
17	Ability to demonstrate proficiency of Bioprocess Technology towards development of processes and products in global context.	☐	☐	3	☐	☐	
18	Ability to apply the knowledge of engineering & applied science to demonstrate research aptitude/skills in frontier areas of biotechnology.	☐	☐	3	☐	☐	

Space for comments: Basic laboratory courses

New Subjects like Medical Coding and Data Analytics will be Helpful for non Wet lab Jobs

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Name of the organization: Aissel Technologies Pvt Ltd Address: IT Park, A Block, 2nd Floor, IT Park,, opposite Indira Glass House, Hubli, Karnataka 580029	
Name of the contact person: Saiprasad W	
e-mail id: saiwandakar@gmail.com	Signature: Saiprasad..

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2	Ability to identify, characterise and formulate a solution plan for solving engineering problems	☐	☐	☐	☐	✓	
3	Ability to execute a solution process and analyse results	☐	☐	☐	☐	✓	
4	Ability to design components, systems or processes that meet specified needs, following appropriate engineering design process	☐	☐	☐	☐	✓	
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6	Ability to critically analyse and interpret data to reach valid conclusions	☐	☐	☐	☐	✓	
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8	Demonstrate an understanding of professional engineering regulations, legislation and standards	☐	☐	☐	☐	✓	
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15	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	☐	☐	☐	✓	☐	
16	Ability to demonstrate adequate proficiency of good laboratory practices (GLP) in terms of accuracy & precision, safety, ethics and reproducibility and able to follow standard operating procedures (SOP).	☐	☐	☐	✓	☐	
17	Ability to demonstrate proficiency of Bioprocess Technology towards development of processes and products in global context.	☐	☐	☐	✓	☐	
18	Ability to apply the knowledge of engineering & applied science to demonstrate research aptitude/skills in frontier areas of biotechnology.	☐	☐	☐	✓	☐	

Space for comments: i) As many control system of industrial importance are MIMO type and hence can be considered for the incorporation of MIMO systems in Bioprocess Control and Automation course.

ii) To give cutting edge technologies exposure to students, think of incorporation of elective courses related to Modeling simulation

ii) Performance of students is on par with industry expectations in terms of technical and ethical

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Name of the organization: Mylan Biologics Address: Bangalore
Name of the contact person: Dinesh C Goudar
e-mail id:dineshgouder@gmail.com Signature:

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Space for comments: i) Think of enhancing the depth of Bioinformatics course which is required for strengthening computation biology skills.

ii) Graduates have been able to quickly adapt to the organization culture and behavior. Work ethics shown by the new recruits have been excellent

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Name of the organization: Aissel Technologies Pvt. Ltd. Address: IT Park Hubli	
Name of the contact person: Praveen Naik	
e-mail id: praveenn@aissel.com	Signature: *Praveen*

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17	Ability to demonstrate proficiency of Bioprocess Technology towards development of processes and products in global context.	☐	☐	√	☐	☐	
18	Ability to apply the knowledge of engineering & applied science to demonstrate research aptitude/skills in frontier areas of biotechnology.	☐	☐	☐	√	☐	

Comments: The guides should teach the literature survey and how to analyse literature. The learnings from the classes needs to be put in projects. Using of DOE softwares, implementing them in projects. Taking up good projects where some industries are working on it and it will help students for getting jobs (Ex. Chromatography techniques for protein purification).

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Name of the organization:Biocon Biologics Limited, Bengaluru Address:Plot No. 1,2,3,4 and, 5, Bommasandra Jigani Link Rd, Bommasandra Industrial Area, Bengaluru, Karnataka 560099
Name of the contact person:Kartik Ganiger
e-mail id:kartik.ganiger@biocon.com Signature:

HEAD
DEPT. OF BIOTECHNOLOGY
K.L.E. TECHNOLOGICAL,
UNIVERSITY, HUBBALLI-31.

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Employers Feedback form

Dear Sir/Madam,

We seek your kind participation in this process of collecting feedback about our graduates serving in your organization. Your inputs will be helping us to make required modifications in the existing curriculum, pedagogy to enhance the competencies of the graduating engineers.For each question, indicate your opinion with a tick mark in the appropriate column. All individual responses will be kept confidential. Only statistically analyzed results from the entire population will be shared.

Regards,

Head of the department

Please rank the following qualities:5 = excellent, **4** = high, **3** = good, **2** = average,**1** = low, NA= Not Applicable

S.No.	Qualities	1	2	3	4	5	NA
1	Ability to apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization for the solution of engineering problems	☐	☐	☐	4	☐	
2	Ability to identify, characterise and formulate a solution plan for solving engineering problems	☐	☐	☐	4	☐	
3	Ability to execute a solution process and analyse results	☐	☐	☐	4	☐	
4	Ability to design components, systems or processes that meet specified needs, following appropriate engineering design process	☐	☐	☐	4	☐	
5	Ability to conduct investigations or tests through design of experiments to understand and solve engineering problems	☐	☐	☐	4	☐	
6	Ability to critically analyse and interpret data to reach valid conclusions	☐	☐	☐	4	☐	
7	Ability to identify / create and use appropriate modern engineering and IT tools, techniques and resources to solve engineering problems	☐	☐	3	☐	☐	
8	Demonstrate an understanding of professional engineering regulations, legislation and standards	☐	☐	☐	4	☐	
9	Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development	☐	☐	☐	4	☐	

10	Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	☐	☐	☐	☐	5	
	Qualities	1	2	3	4	5	NA
11	Ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	☐	☐	☐	4	☐	
12	Ability to comprehend technical literature and prepare effective reports and design documents	☐	☐	☐	4	☐	
13	Demonstrate competence in listening, speaking, and presentation	☐	☐	☐	☐	5	
14	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	☐	☐	☐	☐	5	
15	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	☐	☐	☐	4	☐	
16	Ability to demonstrate adequate proficiency of good laboratory practices (GLP) in terms of accuracy & precision, safety, ethics and reproducibility and able to follow standard operating procedures (SOP).	☐	☐	☐	4	☐	
17	Ability to demonstrate proficiency of Bioprocess Technology towards development of processes and products in global context.	☐	☐	☐	4	☐	
18	Ability to apply the knowledge of engineering & applied science to demonstrate research aptitude/skills in frontier areas of biotechnology.	☐	☐	☐	4	☐	

Space for comments: Looking into pharma industries practices the students of Biotechnology, should be made aware about Process Modeling Simulation. More of hands on experience with better skill s are expected.

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Name of the organization: Shilpa Biologicals Address: Belur Industrial Area, Dharwad	
Name of the contact person:	
e-mail id:	Signature:

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Pre-BOS Meeting No.1 / Academic Semester 2018-19 Date: 22/03/2019

NOTICE

PRE-BOS DEPARTMENT MEETING

All the Staff Members are requested to attend the Pre-BOS Department meeting at H.O.D. chamber on 22nd March 2019 at 3.30 pm the agenda of the meeting is as follows.

AGENDA

1. Pre-BOS discussion
2. Any other topics with the permission of the chair

Dr. Uday M. Muddapur
H. O. D.

To,

1. Dr. B. S. Hungund
2. Dr. L.R.Patil
3. Dr. V. S. Hombalimath
4. Dr. Zabin.K. Bagewadi
5. Dr. Shivalingasarj V Desai
6. Mr. Anil R. Shet
7. Mr. Gururaj Tennalli.
8. Mr. Deepak Yaraguppi
9. Mr. Sharanappa.A.

MINUTES OF PRE-BOS MEETING

Pre-BOS Meeting Number: 1	**Date: 22/03/19**
Venue: HOD'S Chamber	**Time: 3.30pm**

Agenda	Input	Actions initiated in previous meeting	Decisions/ proceedings	Person Responsible	Reasons/Remarks
Pre-BOS Discussion	HOD	----	Pre-BOS discussion was held with all the staff members. All the staff members were asked to go through their respective theory and lab courses, and update the syllabus. Two groups were made to review the syllabus of engineering and life science courses.	Faculty	----
Any other topics with the permission of the chair	----	----	----	----	----

Staff secretary:

Staff:

HOD:

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Pre-BOS Meeting No.2 / Academic Semester 2018-19

Date: 25/03/2019

NOTICE

PRE-BOS DEPARTMENT MEETING

All the Staff Members are requested to attend the Pre-BOS Department meeting at H.O.D. chamber on 25th March 2019 at 3.00 pm the agenda of the meeting is as follows.

AGENDA

1. Pre-BOS discussion
2. Any other topics with the permission of the chair

Dr. Uday M. Muddapur
H. O. D.

To,

1. Dr. B. S. Hungund
2. Dr. L.R.Patil
3. Dr. V. S. Hombalimath
4. Dr. Zabin.K. Bagewadi
5. Dr. Shivalingasarj V Desai
6. Mr. Anil R. Shet
7. Mr. Gururaj Tennalli.
8. Mr. Deepak Yaraguppi
9. Mr. Sharanappa.A.

MINUTES OF PRE-BOS MEETING

Pre-BOS Meeting Number: 2	**Date: 25/03/19**
Venue: HOD'S Chamber	**Time: 3.00pm**

Agenda	Input	Actions initiated in previous meeting	Decisions/ proceedings	Person Responsible	Reasons/Remarks
Pre-BOS Discussion	HOD	All the staff members were asked to update their respective courses. Two groups were formed to review the engineering and life science courses.	Pre-BOS discussion was held with all the staff members. All the courses were reviewed by the two review groups which were formed in the previous Pre-BOS meeting. The groups suggested the courses which required the modification to be done. The following courses needed modification: Microbiology, Molecular biology laboratory, Genetic engineering and applications, research methodology, Bioprocess control and automation.	Faculty	----
Any other topics with the permission of the chair	----	----	----	----	----

Staff secretary:

Staff:

HOD:

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Pre-BOS Meeting No.3 / Academic Semester 2018-19 Date: 28/03/2020

NOTICE

PRE-BOS DEPARTMENT MEETING

All the Staff Members are requested to attend the Pre-BOS Department meeting at H.O.D. chamber on 28th March 2019 at 3.00 pm the agenda of the meeting is as follows.

AGENDA

1. Pre-BOS discussion
2. Any other topics with the permission of the chair

Dr. Uday M. Muddapur
H. O. D.

To,

1. Dr. B. S. Hungund
2. Dr. L.R.Patil
3. Dr. V. S. Hombalimath
4. Dr. Zabin.K. Bagewadi
5. Dr. Shivalingasarj V Desai
6. Mr. Anil R. Shet
7. Mr. Gururaj Tennalli.
8. Mr. Deepak Yaraguppi
9. Mr. Sharanappa.A.

MINUTES OF PRE-BOS MEETING

Pre-BOS Meeting Number: 3	**Date: 28/03/19**
Venue: HOD'S Chamber	**Time: 3.00pm**

Agenda	Input	Actions initiated in previous meeting	Decisions/ proceedings	Person Responsible	Reasons/ Remarks
Pre-BOS Discussion	HOD	The courses to be modified were identified by the review groups. The responsibility of updating the courses was given to the course instructor.	Pre-BOS discussion was held with all the staff members. The updated courses were reviewed in the meeting and modified. Bioethics, safety and IPR course was chosen as the new department elective and the course content was reviewed. *Overall scheme of the program, semester wise curriculum structure was approved in the meeting by all the faculty members. *Inputs were taken from all the stake holders for BOS preparation. * Inputs from PEO- Mapping of CLO with PO and Previous review outcomes were taken for BOS preparation.	Faculty	----
Any other topics with the permission of the chair	----	----	----	----	----

Staff secretary:

Staff:

HOD:

Consolidated report feedback collected and analysis reports:

Alumni feedback:

- Alumni expressed that as many control systems of industrial importance are Multiple Input and Multiple Output (MIMO) type , and hence they expressed to incorporate concepts of Block diagram reduction pertaining to MIMO systems.
- This will help students to understand & appreciate real world control problems.

Teacher's feedback:

- In line with Alumni feedback even teachers also expressed the need for incorporation of concepts of MIMO systems in block diagram analysis for better understanding of complex control systems.

Actions taken	Course Revised/ Added	BoS approved Date
Action3: Providing lab sessions for structured enquiry and open-ended experiments to improve student's reasoning ability and experimental investigations. Hands-on sessions are planned for the few laboratory courses and project work.	**Content modification:** Biochemistry Lab Enzyme Technology Lab Mini Project Minor Project	07/04/2018
Action 4: Implementation of Minor project as flagship course to increase technical ability and team work among students. Example: Characterization of microorganisms based upon both biochemical and molecular characteristics in the execution of Minor project (15EBTW302).	**Course teaching:** Mini Project Minor Project Biopharmaceuticals	

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DEPARTMENT OF BIOTECHNOLOGY

5th Board of Studies (BOS) Meeting of Biotechnology Engineering (UG) Programme 13th April 2019

MEETING AGENDA

1. Approval of Curriculum structure from III to VIII Semester of 2019-23 Batch
2. Approval of detailed content of III and IV semester courses of 2018-22 Batch
3. Approval of detailed content of V and VI semester courses of 2017-21 Batch
4. Approval of detailed content of VII and VIII semester courses of 2016-20 Batch
5. Any other subject related to syllabus.

Meeting Date: **13 - 04 - 2019**
Time: **10.00 AM**
Venue: **H.O.D Chamber,**
Biotechnology Department

Chairman

Dr. Uday M. Muddapur
HOD
HEAD
DEPT. OF BIOTECHNOLOGY
K.L.E. TECHNOLOGICAL
UNIVERSITY, HUBBALLI-31.

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HUBBALLI-580 031

Copy to: All the members of BOS

DEPARTMENT OF BIOTECHNOLOGY

Proceedings of the 5th Board of Studies (B. E. Biotechnology Programme) Meeting held on 13-04-2019 at the Department of Biotechnology.

Board of Studies met on 13-04-2019 to discuss the following agenda

1. Approval of Curriculum structure from III to VIII Semester of 2019-23 Batch
2. Approval of detailed content of III and IV semester courses of 2018-22 Batch
3. Approval of detailed content of V and VI semester courses of 2017-21 Batch
4. Approval of detailed content of VII and VIII semester courses of 2016-20 Batch
5. Any other subject related to syllabus.

After the deliberate discussions the following decisions were made

1. Approved the suggested Curriculum structure from III to VIII semester of 2019 - 23 Batch with no changes (*Annexure-I*)
2. Approved the detailed content of III and IV semester courses of 2018-22 Batch with some suggestions (*Annexure-II*)
3. Approved the detailed content of V and VI semester courses of 2017-21 Batch with some suggestions (*Annexure-III*)
4. Approved the detailed content of VII and VIII semester courses of 2016-20 Batch with some suggestions (*Annexure-IV*)

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DEPARTMENT OF BIOTECHNOLOGY

Members present at the 5th B.O.S. Meeting dated 13th April 2019

Sl. No.	Name	Signature
1	**Dr. Uday M. Muddapur,** Professor and Head. Department of Biotechnology, K.L.E Technological University, Vidyanagar, Hubli – 580 031.	**CHAIRMAN**
2	**Dr. Vijaysai P.** Consulting Engineer SUEZ Water Technologies and Solutions Whitefield, Bangalore-560066	MEMBER
3	**Dr. K.S. Jagadeesh** Professor (Agril. Microbiology) Dept of Forest Biology College of Forestry Sirsi-581 401	Absent MEMBER
4	**Dr. Rajyashree K. R.** Chief Scientific officer Shilpa Medicare Pvt Ltd Incubation Centre K.L.E Technological University, Vidyanagar, Hubli – 580 031.	MEMBER
5	**Dr. Sudeep Kumar** Head-R&D,QC, QA and Manufacturing of recombinant therapeutic proteins, Unichem Laboratories Ltd, Goa-403511	Absent MEMBER
6	**Mr. Anand Hiremath** Scientist –I/ Deputy Manager Aurozymes, Aurobindo Pharma, Hyderabad-500 084	MEMBER 13/04/2019

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DEPARTMENT OF BIOTECHNOLOGY

7	**Mr. Sai Srikar Kandukuri** Deputy Manager, Biocon limted, Bangalore- 560 100	MEMBER
8	**Mr. Dinesh C. Goudar** Manager, Manufacturing Science, Mylan Pharmaceuticals private limited Bangalore-560 087	MEMBER
9	**Dr. Basavaraj S. Hungund** Professor, Department of Biotechnology, K.L.E. Technological University, Vidyanagar, Hubli – 580 031.	MEMBER
10	**Dr. L. R. Patil** Associate Professor Department of Biotechnology, K.L.E. Technological University, Vidyanagar, Hubli – 580 031.	MEMBER
11	**Dr. S. V. Desai** Associate Professor, Department of Biotechnology, K.L.E. Technological University, Vidyanagar, Hubli – 580 031.	MEMBER
12	**Prof. Anil R. Shet** Assistant Professor, Department of Biotechnology, K.L.E. Technological University, Vidyanagar, Hubli – 580 031.	MEMBER
13	**Miss Haripriya** Student Department of Biotechnology K.L.E.Technological University, Vidyanagar, Hubli-580031	MEMBER

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HUBBALLI-580 031

Department of Biotechnology

Recommendations of 5th Board of studies of KLE Technological University (Biotechnology) meeting held on 13/04/2019

Annexure-I

Agenda-1: Approval of Curriculum structure from III to VIII Semester of 2019-23 Batch.

- No changes were expressed by the BOS members

Annexure-II

Agenda-2: Approval of detailed content of III and IV semester courses of 2018-22 Batch

1. Microbiology:
The BOS members suggested to include "Microbes and human society, Microbial applications in agriculture, veterinary, healthcare, industry and environment" in microbiology course.

2. Microbiology Laboratory:
One new open ended experiment has been proposed in Microbiology laboratory. It was accepted by the BOS members with no changes.

3. Cell and Molecular Biology Laboratory:
One exercise experiment has been converted to open ended experiment. It was accepted by the BOS members with no changes.

Annexure-III

Agenda-3: Approval of detailed content of V and VI semester courses of 2017-21 Batch.

1. Genetic Engineering and applications:
The BOS members suggested to include "Ethical, Social, Economical and Political issues related to Gene modification and Genetic Engineering" in genetic engineering and applications course.

2. Genetic Engineering & Immunotechnology Laboratory:
Two exercise experiments are converted to structured enquiry experiments. It was accepted by the BOS members with no changes.

3. Research Methodology:
As per the suggestions of BOS members, the course content should include "author h-index and i10-index, awareness on predatory journals and its identification, grants and funding agencies for biotechnology research, Design of matrix and analysis, Contour plots and response surface plots, Introduction to Artificial Intelligence and its application in biotechnology". The members also suggested to swap chapter 5 and 6 for proper flow of the course.

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4. Bioinformatics: With inputs from BOS members the course content of Bioinformatics course has been modified to include recent developments in Computational Biology. Subsequently credit weight age has been changed from 3 credits to 4 credits.

5. Bioprocess Control and automation:
The BOS members suggested including one chapter on multiple input and multiple output systems (MIMO systems) in Bioprocess control and automation course.

6. As per the inputs from the stake-holders (Alumni Feedback), new elective Bioprocess Modelling and Simulation was introduced at VI Semester.

Annexure-IV

Agenda-4: Approval of detailed content of VII and VIII semester courses of 2016-20 Batch. The following were the changes suggested by the BOS members

1. Plant and Animal Biotechnology:
The BOS members suggested to include "Ethical and Social issues related to development and release of transgenic plants with case studies – Bt Cotton" in plant and animal Biotechnology elective course.

8th Semester Courses

1. Industrial Waste Management: This new open elective has been proposed in 8th Semester to address civil and mechanical engineering students. This course was accepted by the BOS members with no changes.

Date: 13-04-2019

Chairman BOS

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DEPARTMENT OF BIOTECHNOLOGY,

KLE TECHNOLOGICAL UNIVERSITY, HUBBALLI – 31

NEW SYLLABUS

Program: Biotechnology		
Course Title: Bioprocess Control and Automation		**Course Code:19EBTC302**
L-T-P: 4-0-0	**Credits: 4.0**	**Contact Hours: 4 hours/week**
ISA Marks:50	**ESA Marks:50**	**Total Marks:100**
Teaching Hours:50	**Examination Duration:3 hrs**	

Unit I

1 Instrumentation & Process Dynamics: Introduction to Measurement of important physicochemical and biochemical parameters in bioprocess. Methods of on line and off line estimation of biomass, substrates and products. Brief introduction to typical automatic control system and its components. Open loop and closed loop control systems. **05 Hours**

2 First & Second Order Systems: Mathematical representation of physical systems. Transfer function representation of linear first order systems, Examples: mercury in glass thermometer & Liquid level system. Mathematical forms of standard Input function/Forcing Functions such as Step input, Impulse Input, Linearly increasing Input and Sinusoidal Input. Response of first order system for step input, Features of step response, Response of linearly increasing input. Conceptual numerical. First Order Systems in Series: Interacting and Non-Interacting systems & their Transfer function representation. Second Order Systems: Transfer function representation of Second order systems, Example: Pneumatic Control Valve. **10 Hours**

Unit II

3 Controller and Final Control Elements: Different types of controllers-P (Special case of P-controller i.e ON-OFF controller), PI, PD, PID controllers. Derivation of Transfer Functions of different types of controllers. Final control element: The role of Final control Element in control system. Example: Pneumatic Control Valve: Working of Pneumatic control valve, Types of Pneumatic Control Valves i.e. Air to close & air to open. **10 Hours**

4 Block Diagram Reduction: Block diagram representation of control systems, Block diagram reduction in case of Servo and Regulatory control systems. Reduction of block diagrams for single input & Single output systems (SISO) & Multiple Input & Multiple Output Systems (MIMO), Problems on block diagram reduction. **05 Hours**

5 Block Diagram Reduction (MIMO systems): Analysis of Multiple Input Multiple Output Systems**:** Introduction to Multiple Input & Multiple Output Systems (MIMO), Examples of MIMO systems.Analysis of MIMO systems considering only one Input at a time while other Inputs are Suppressed. Considering only one output at a time while other outputs are Suppressed. Problems on block diagram reduction considering MIMO systems. **05 hours**

Unit III

6 Transient response of different controllers for Servo & Regulatory control Problems: Transient response of P, PI, PD & PID controllers for servo and regulatory problems. The determination of offset in all cases. **05 Hours**

7 Analysis of Stability: Concept of stability, stability criterion. Routh test for stability. Theorems of Routh Array test, Conceptual numerical on Routh test for stability. **05 hours**