COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Department of Biochemical Engineering and Biotechnology
2.	**Course Title** *(< 45 characters)*	BIOPROCESS ENGINEERING LABORATORY
3.	**L-T-P structure**	0-0-3
4.	**Credits**	1.5
5.	**Course number**	BBP332
6.	**Status** (*category* for *program*)	Departmental Core (DC)

7.	**Pre-requisites** (course no./title)	BBL131 and BBL132

8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NO
8.2	Overlap with any UG/PG course of other Dept./Centre	NO
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	

10.	**Frequency of offering**	☐Every sem ☐1st sem ☒2nd sem ☐Either sem

11.	**Faculty who will teach the course** 1. Ravikrishnan E 2. A.K.Srivastava 3. Shaikh Ziauddin Ahammad 4. T.R.Sreekrishnan	
12.	**Will the course require any visiting faculty?**	NO

13.	**Course objective** *(about 50 words)***:** To impart and develop design skills among the students so that they will have a hands-on experience to design, develop and run Bioreactors of laboratory scale to industrial reactors.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:** Design and execution of simple laboratory scale experiments on the following topics: Estimation of cell mass; different phases of microbial growth; Mass and energy balance in a typical bioconversion process; Concept of limiting nutrient and its effect on cell growth; growth inhihition kinetics; product formation kinetics in a fermentation process; aerobic and anaerobic bioconversion process; power consumption in a fermentation process and its correlation with rheology of the fermentation fluid; different agitator types; mixing time in a

	bioreactor; quantification of KLa in a fermentation process; Heat balance across a batch sterilization process; Assembly and characterization of pH/DO electrodes.

15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
COURSE TOTAL *(14 times 'L')*		

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Sterilization in Steam Autoclave	2
2	Estimation of growth rate and yield	2
3	Dimensionless mixing time	2
4	Operation of pH control system	2
5	Dissolved oxygen (DO) measurement system	2
6	Blank sterilization of the reactor	2
7	Estimation of volumetric oxygen transfer coefficient	2
8	Estimation of volumetric oxygen transfer coefficient (KLa) in a fermentor by dynamic gassing out technique.	2
9	Estimation of power required for liquid agitation (PL)	2
10	Independent design project	8
COURSE TOTAL *(14 times 'P')*		26

18. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. "Biochemical Engineering Fundamentals", J.E.Bailey and D.F.Ollis, McGraw Hill Book Co.
2. "Bioprocess Engineering: Basic Concepts", M.L.Schuler and F.Kargi, Prentice Hall
3. "Biochemical Engineering", S.Aiba, A.E.Humphrey and N.F.Milles, Academic Press

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	National Instruments Labivew
19.2	Hardware	

19.3	Teaching aides (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	Bioreactors
19.6	Classroom infrastructure	
19.7	Site visits	

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	40
20.5	Others (please specify)	

Date: (Signature of the Head of the Department)