2018

[OBE DESIGN- BIOTECHNOLOGY DEPARTMENT]

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY AURANGABAD-431 001

PREFACE

Outcome Based Education (OBE) is the educational approach which focuses on student centric education in the context of development of personal, social, professional and knowledge (KSA) requirements in one's career and life. It is the decade ago curriculum development methodology. The educational triangle of *LEARNING-ASSESSMENT-TEACHING* is the unique nature of the OBE approach. The curriculum practices such as Competency Based Curriculum, Taylor's Model of Curriculum Development, Spadys' Curriculum principles, Blooms taxonomy and further use of assessment methodologies like, Norm-reference testing and Criterion reference testing, etc is being practiced since decades. It is also interesting to know that, globally, different countries and universities adopts the curriculum development models/approaches such as, CDIO (Conceive-Design-Implement-Operate), Evidenced Based Education, Systems' Approach, etc as the scientific and systematic approaches in curriculum design.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome of different meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of OBE. This is the first step towards the implementation of OBE in the department. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university department.

Head of Department

INDEX

OUTCOME BASED EDUCATION

Faculty of Science & Technology

Department of Biotechnology

1. Mission:

Mission Statement

- To offer post-graduate and research program in biotechnology.
- To develop the graduates with globally emerging knowledge and competencies in the domain of biotechnology.
- To experiment and analyse for product/process development.
- To provide experimental, field based and practice based teaching facilities.
- To develop the manpower for employment/research with values and ethics.

2. Vision:

Vision Statement

- To establish the centre for training, research and development in collaboration and support from the funding agencies/financial support.
- To emphasis on research activities with the support from the head of the university. The faculty members will undertake Minor/Major research projects with financial assistance from UGC, ICSSR and other funding agencies.
- To procure Audio-visual teaching aids and internet would be used liberally for class room instruction.

3. Title of the Program (s):

a. Master of Bio-technology

4. Program Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ post-graduation). The PEO s are driven form question no. (ii) of the Mission statement (What is the purpose of organization). The PEOs can be minimum three and maximum five.

PEO1: To have advance knowledge and apply theories and principles of Immunology, Microbiology, Gene engineering and biology/molecular biology in the domain of industry, research and development.

PEO2: To provide the professional services to industry, research organization, institutes.

PEO3: To provide the professional consultancy and research support for the relevant organization in the domain of super specialization.

PEO4: To opt for higher education, disciplinary & multi-disciplinary research and to be a life-long learner.

PEO5: To provide, value based and ethical leadership in the professional and social life.

5. Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the graduate/ post-graduate will have by the end of program studies.

a. To enhance depth of understanding of the current knowledge and skills of the cellular and molecular life sciences.
b. An ability to independently carry out research /investigation and development Work to solve practical problems.
c. An ability to write and present a substantial technical report/document.
d. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
e. An ability to handle/experiment with Bioinstrumentation, Gene engineering Tissue technology and Bioinformatics.
f. To develop facility with business practices and culture

6. Course- Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular-extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, ***"to which POs his/her course in contributing?"***. So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Corse-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between

the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs.

The template is provided in the below table.

Course Title	a	b	c	d	e	f	PSO
Biomathematics and Biostatistics	*			*			
Biomolecules and Bioenergetics	*			*			
Microbiology	*			*			
Inheritance Biology	*			*			
P-BT 1001	*			*			
P-1002	*			*			
P-1003	*			*			
P1004	*			*			
Molecular biology	*			*			
Basic immunology	*			*			
P-BT 2001	*			*			
P-2002	*			*			
P-2003	*			*			
P-2004	*			*			
Applied Immunology and virology	*	*		*	*		
Gene expression and engineering	*	*		*	*		
Developmental Biology	*	*		*	*		
Bioinstrumentation	*	*		*	*		
Service course	*			*	*		
P-BT 3001	*	*		*	*		
P-3002	*	*		*	*		
P-3003	*	*		*	*		
P-3004	*	*		*	*		
Industrial technology	*			*	*	*	
Recombinant DNA Technology	*	*		*	*	*	
Tissue technology	*	*		*	*	*	
Bioinformatics	*	*		*	*	*	
Dissertation		*	*	*	*	*	
P-BT 4001		*	*	*	*	*	
P-4002		*	*	*	*	*	

7. Course Outcomes (for all courses):

The course outcomes are the statement that describes the knowledge & abilities developed in the student by the end of course (subject) teaching. The focus is on development of abilities rather than mere content. There can be 5 to 7 course outcomes of any course. These are to be written in the specific terms and not in general. The list of Course Outcomes is the part of ***Annexure-C*** attached herewith.

8. Set Target levels for Attainment of Course Outcomes:

The course outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment are measured/calculated. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

9. Set Target level for Attainment of Program Outcomes:

The program outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment and program outcome attainment is measured/calculated. The program outcome attainment is governed by curricular, co-curricular and extra-curricular activities including the stakeholders' participation. The direct method and indirect method is adopted to calculate the PO attainment. The direct method implies the attainment by course outcomes contributing to respective program outcomes. And indirect method is the satisfaction/feed-back survey of stakeholders. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is the set benchmark to ensure the continuous improvements in the learners/ graduates' performance.

10. Course Attainment Levels:

a. CO attainment is defined/set at three levels;
b. The CO attainment is based on end term examination assessment and internal assessment;
c. The Co attainment is defined at three levels in ascending order-
    i. e.g. For end term and internal examination;
    ii. Level-1: 30% students scored more than class average
    iii. Level-2: 40% students score more than class average;
    iv. Level-3: 50% students score more than class average.
d. The target level is set (e.g. Level-2). It indicates that, the current target is level-2; 40% students score more than class average. The CO attainment is measured and the results are obtained. Based on the results of attainment, the corrective measures/remedial action are taken.
e. CO Attainment= 80% (Attainment level in end term examination) + 20% (Attainment level in internal examination).

11.Program attainment Level:

a. PO attainment is defined at five levels in ascending order;
b. The PO attainment is based on the average attainment level of corresponding courses (Direct Method) and feed-back survey (Indirect method);
c. The PO attainment levels are defined / set as stated below;
    i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1)- Poor
    ii. Level-2: 1.0>1.5-Average
    iii. Level-3: 1.5>2.0-Good
    iv. Level-4: 2.0>2.5-Very Good
    v. Level-5: 2.5>3.0 -Excellent
d. The PO attainment target level is set/defined (say, Level-4). It implies that, the department is aiming at minimum level-4 (very good) in the performance of abilities by the graduates. Based upon the results of attainment, the remedial measures are taken;
e. PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

12. The Results of CO Attainment:

The Results of CO attainment are provided in Annexure-B

For Example,

BT-3003

e.g. For end term and internal examination;

i. Level-1: 30% students scored more than class average
ii. Level-2: 40% students score more than class average; iv.
iii. Level-3: 50% students score more than class average

Average Marks in External examination: 47.27 = i.e. 47

% Students score more than 37 is 54.5% i.e. Levl-3

Average Marks in Internal examination= 14.64= i.e. 15

% Students score more than. 14.64 is 63.60% i.e. Level-3

A(CO) BT-3003= 80% (3)+20(3) 11/18=

=2.4+0.6

=3.0

Table No. 1.0: CO Attainment Level

Course Title	CO Attainment Value	Target Attainment Level	Fully Attained/Not attained	Remedial measures
Biomathematics and Biostatistics	1.4	2	Not Attained	Remedial Measures such as assignment, tutorials and remedial coaching.
Biomolecules and Bioenergetics	1	2	Not Attained	
Microbiology	1.2	2	Not Attained	
Inheritance Biology	2.8	2	Fully Attained	
P-BT 1001	1	2	Not Attained	Remedial Measures such as assignment, tutorials and remedial coaching.
P-1002	1	2	Not Attained	
P-1003	1	2	Not Attained	
P1004	1	2	Not Attained	
Molecular biology	2	2	Fully Attained	
Enzyme Technology	2.2	2	Fully Attained	
Cell Biology	1.2	2	Not Attained	Remedial Measures such as assignment, tutorials and remedial coaching.
Basic immunology	2	2	Fully Attained	
P-BT 2001	1	2	Not Attained	Remedial Measures such as assignment, tutorials and remedial coaching.
P-2002	3	2	Fully Attained	
P-2003	3	2	Fully Attained	
P-2004	3	2	Fully Attained	
Applied Immunology and virology	1	2	Not Attained	Remedial Measures such as assignment, tutorials and remedial coaching.
Gene expression and engineering	2.8	2	Fully Attained	
Developmental Biology	3	2	Fully Attained	
Bioinstrumentation	3	2	Fully Attained	
Service course	3	2	Fully Attained	
P-BT 3001	3	2	Fully Attained	
P-3002	3	2	Fully Attained	
P-3003	3	2	Fully Attained	
P-3004	2	2	Fully Attained	
Industrial technology	2.2	2	Fully Attained	
Recombinant DNA Technology	1.4	2	Not Attained	Remedial Measures such as assignment, tutorials and remedial coaching.
Tissue technology	1.4	2	Not Attained	
Bioinformatics	1.8	2	Not Attained	

Dissertation	3	2	Fully Attained	
P-BT 4001	0	2	Not Attained	Remedial Measures such as assignment, tutorials and remedial coaching.
P-4002	3	2	Fully Attained	

13. The Results of PO Attainment:

The Results of Po attainment are provided in Annexure-B

For Example,

The description of PO levels and target level is stated in point No. 11.

PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

A(PO)e= 80% (1+2.6+3+3+3+3+3+3+2+2.2+1.4+1.4+1.8+3+0+3)/16 +20% (2.28)

= 80% (2.2875) + 20 %(2.28)

= 1.83+0.46

=2.29

Table No. 2.0 PO Attainment Level

PO/PSO number	PO Attainment Value	Target Attainment level	Fully attained/ Not Attained	Remedial Measures
a	2.01	4	Fully attained	
b	2.24	4	Fully attained	
c	2.00	4	Fully attained	
d	2.01	4	Fully attained	
e	2.29	4	Fully attained	
f	1.83	4	Not attained	Remedial Measures such as assignment, tutorials and remedial coaching.

14. Planned Actions for Course Attainment:

The courses having CO attainment less than Level-4 shall be addressed by designing remedial measures such as assignments, tutorials and remedial lectures.

15.Planned Actions for Program Outcome Attainment:

The POs having attainment level less than Level-4 shall be addressed by designing remedial measures for corresponding courses with respect to that PO.

ANNEXURE-B
RESULTS OF CO-PO ATTAINMENT

MASTER OF BIOTECHNOLOGY 30 40 50

Course Title	a	b	C	d	E	f	PSO
Biomathematics and Biostatistics	1.4			1.4			
Biomolecules and Bioenergetics	1			1			
Microbiology	1.2			1.2			
Inheritance Biology	2.8			2.8			
P-BT 1001	1			1			
P-1002	1			1			
P-1003	1			1			
P1004	1			1			
Molecular biology	2			2			
Enzyme Technology	2.2			2.2			
Cell Biology	1.2			1.2			
Basic immunology	2			2			
P-BT 2001	1			1			
P-2002	3			3			
P-2003	3			3			
P-2004	3			3			

Applied Immunology and virology	1	1		1	1		
Gene expression and engineering	2.8	2.8		2.8	2.8		
Developmental Biology	3	3		3	3		
Bioinstrumentation	3	3		3	3		
Service course	3			3	3		
P-BT 3001	3	3		3	3		
P-3002	3	3		3	3		
P-3003	3	3		3	3		
P-3004	2	2		2	2		
Industrial technology	2.2			2.2	2.2	2.2	
Recombinant DNA Technology	1.4	1.4		1.4	1.4	1.4	
Tissue technology	1.4	1.4		1.4	1.4	1.4	
Bioinformatics	1.8	1.8		1.8	1.8	1.8	
Dissertation		3	3	3	3	3	
P-BT 4001		0	0	0	0	0	
P-4002		3	3	3	3	3	
	2.01	2.24	2	2.01	2.29	1.83	

ANNEXURE-C

COURSE OUTCOMES

BIOMATHEMATICS AND BIOSTATISTICS

- Select from, use and interpret results of, mathematical models and descriptive statistical methods effectively;
- Demonstrate an understanding of the central concepts of biomathematics and modern statistical theory and their probabilistic foundation;
- Select from, use, and interpret results of, the principal methods of mathematical and statistical inference and design;
- Communicate the results of statistical analyses accurately and effectively;
- Make appropriate use of statistical software.
- Read and learn new statistical procedures independently

BIOMOLECULES AND BIOENERGETICS

- Identify the structure of basic biomolecules in the cell as well as the macromolecules they form.
- Describe the role buffering plays in chemical reactions of the cell.
- Operate/implement protein-substrate interactions and how to characterize these interactions.
- Describe the enzyme function and activity and characterize the type of enzyme by use of kinetics.
- Describe the dynamic role biological membranes play in transport and investigate their coordination in biosignalling pathways.
- Examine the catabolic and anabolic reactions of central intermediate metabolism and apply these principles to the understanding of cellular status.
- Analyse the relation between biochemical defects and metabolic disorders.
- Identify/locate the metabolic basis of cancer, diabetes and other diseases

Microbiology

- Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology.
- Identify ways microorganisms play an integral role in disease, and microbial and immunological methodologies are used in disease treatment and prevention.
- Explain why microorganisms are ubiquitous in nature; inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
- Cite examples of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human well being.

- Demonstrate that microorganisms have an indispensable role in the environment, including elemental cycles, biodegradation, etc.

INHERITANCE BIOLOGY

- Describe the concept and Mendelian principles of gene.
- Describe Mutation and structural alternation of chromosome.
- Implement the gene transfer methods.
- Map the genes.
- Describe the inheritance of gene.

Research methodology in Biotechnology

- Develop essential research and practical skills in the field of biomedical science.
- Demonstrate an understanding of the importance of the practical aspects of research platforms/techniques currently used in biomedical research.
- Demonstrate the skills required for basic laboratory procedures and principles of reagent preparation.
- Demonstrate safe laboratory working practice.
- Demonstrate an understanding of the importance of experimental design, technique and proficiency.
- Demonstrate an understanding of basic research methodologies.
- Demonstrate an ability to understand and follow the Office of the Gene Technology Regulator (OGTR) guideline requirements.
- Demonstrate an understanding of ethical issues associated with research in biomedical research.
- Demonstrate an understanding of the importance of GLP, GMP and GCP.
- Critically analyse and interpret data generated from specific research Problems.

Molecular Biology

- Describe biological and/or medicinal processes through the investigation of the underlying molecular mechanisms.
- Molecular Biology gives you in-depth knowledge of biological and/or medicinal processes through the investigation of the underlying molecular mechanisms
- Describe chemical and molecular processes that occur in and between cells.
- Implement the chemical and molecular processes that occur in and between cells.
- To describe and explain processes and their meaning for the characteristics of living organisms.
- Implement molecular and cell-based methods used to expand our understanding of biology.

Enzyme Technology

- Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms
- Apply biochemical calculation for enzyme kinetics
- Compare methods for production, purification, characterization and immobilization of enzymes
- Discuss various application of enzymes that can benefit human life
- Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.
- Plot graphs based on kinetics data

Cell Biology

- Describe the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Demonstrate the process of generate and utilize energy in cells by cellular components
- Describe the cellular components underlying mitotic cell division.
- Apply knowledge of cell biology to selected examples of changes or losses in cell function.

Basic Immunology

- Outline the key components of the innate and adaptive immune responses.
- Describe which cell types and organs are involved in an immune response.
- Describe the basis structure of the cellular receptors and discuss their interactions during an immune response.
- Differentiate between different Hypersensitivity states.
- Identify the main mechanisms of immune tolerance and autoimmunity.
- Describe the principles governing vaccination and the mechanisms of protection against disease