

UNIVERSITY OF MUMBAI



**Syllabus for the T.Y.B.Sc.
(APPLIED COMPONENT)**

Program: B.Sc.

Course : BIOTECHNOLOGY (USACBT)

(Credit Based Semester and Grading System with
effect from the academic year 2013–2014)

Programme: B.Sc
Course :Applied Component(USAC)
(Semester –V & VI)

PREAMBLE

Applied Component was introduced for T.Y.B.Sc. class in the academic year 1979-80 with a view to enhance essence for employability. There are several combinations of Applied component courses with Microbiology as a Major Course. The three applied component courses under the umbrella of BOS in Microbiology are-

- i. Biotechnology (USACBT)**
- ii. Food Production and Processing (USACFP)**
- iii. Medical Laboratory Technology (USACMT)**

In the syllabi of these applied components, applied topics having commercial propositions have been incorporated that further adds to the enhancement of entrepreneurial potential and skills amongst the learners.

From the academic year 2011-12, the University has introduced Credit Based Semester and Grading System (CBSGS) with continuous evaluation involving Internal Assessment and External Assessment. Accordingly the existing syllabi of these applied components have been restructured to fit into the CBSGS pattern. Sub-committees were formed with Dr. D.B.Thakare as the convener, BOS members as co-conveners and Head/ Senior teachers from affiliated colleges as members of these sub-committees.

As mentioned in the outline of the syllabus, each semester (Semester –V & VI) consists of one theory and one practical course of 100 marks each.

T. Y. B.Sc.
Biotechnology (Applied Component)
Course code - USACBT

SEMESTER V

Course Code	UNIT	TOPICS	Credits	L / Week
USACBT501		CONCEPTS IN BIOTECHNOLOGY	2	
	I	Importance of Biotechnology and Tools in Genetic Engineering		1
	II	Techniques in Genetic Engineering		1
	III	Methods in Industrial Biotechnology and Bioinformatics		1
	IV	Industrial Biotechnology		1
USACBT5P1	Practicals based on above course in theory		2	4

SEMESTER VI

Course Code	UNIT	TOPICS	Credits	L / Week
USACBT601		APPLIED BIOTECHNOLOGY	2	
	I	Agricultural, Animal and Plant Biotechnology		1
	II	Animal and Plant Biotechnology		1
	III	Environmental Biotechnology		1
	IV	Health Care Biotechnology		1
USACBT6P1	Practicals based on above course in theory		2	4

T. Y. B.Sc.
BIOTECHNOLOGY(Applied Component) Syllabus
Credit Based and Grading System
To be implemented from the Academic year 2013-2014
SEMESTER V

Course Code	UNIT	TOPICS	Credits	Lec / Sem
USACBT501		CONCEPTS IN BIOTECHNOLOGY	2	(60 lectures)
	I	<p>1. Importance of Biotechnology and Tools in Genetic Engineering.</p> <p>1.1 History of Biotechnology – Traditional and Modern Biotechnology. Biotechnology as an interdisciplinary area, Global impact and current excitements of Biotechnology. (Health care, Agriculture, human genome project, environment), Biodiversity and its preservation. (04L)</p> <p>1.2 Tools in Genetic Engineering</p> <p>a) Basic requirements : Electrophoresis, agarose gel electrophoresis, Pulse field gel electrophoresis (PFGE), SDS-PAGE, 2D gel electrophoresis. (02L)</p> <p>b) Spectrophotometry, Matrix assisted laser desorption ionization (MALDI), Surface enhanced laser desorption ionization (SELDI), Electro spray ionization (ESI), UV and Visible, Amplified polymerase DNA(RAPD market),AP-PCR, DNA amplification Finger Printing (DAF), Applications of PCR. (05L)</p> <p>c) Blotting Techniques: Southern, Northern and Western blotting. DNA sequencing, Probes, ELISA, RIA, Nick translation and in situ Hybridization. (04L)</p>		15 Lectures
	II	<p>Techniques in Genetic Engineering</p> <p>2.1. Cutting and joining of DNA, Exonucleases, Endonucleases, Restriction Endonucleases (Type I, II, III). Examples of some enzymes – DNA ligases, Alkaline Phosphatases, DNA polymerases, Use of Linkers and Adaptors (05L)</p> <p>2.2. Cloning Vectors : Properties of good vector, Cloning and Expression vectors. <i>E. coli</i> vectors – Plasmid, Cosmid, Phagmid, Bacteriophage vectors. Vectors for other bacteria. Shuttle vectors, Yeast vectors, Vectors for animals and plants. (05L)</p> <p>2.3. Steps in gene cloning. Isolation of desired gene, cDNA library, Genomic library, Chemical synthesis of gene. Gene amplification by PCR. Introduction of vector in to suitable</p>		15 lectures

		bacterial host (various transformation methods). Selection of recombinant clones, selection of clones containing recombinant vector, selection of clones containing specific DNA inserts, colony hybridization test. (05L)		
	III	<p>Methodology in Industrial Biotechnology and Bioinformatics</p> <p>3.1 Bioreactors- Major types, solid – state fermentation, Immobilization techniques. Down stream processing, Enzyme extraction and Purification.(Amylases and proteases) (07L)</p> <p>3.2 Legal, Social and ethical aspects of Biotechnology. Patent Laws, Bioethics, and Bioterrorism (05L)</p> <p>3.3 Genomics, Proteomics and Bioinformatics. – Genomic and Protein data base, data similarity search BLAST and FASTA (03L)</p>		15 Lectures
	IV	<p>Industrial Biotechnology</p> <p>4.1 Exploitation of Microorganisms to produce primary and secondary metabolites : Amino acids (lysine), Vitamin B12 (02L)</p> <p>4.2. Synthesis of Novel Antibiotics – Engineering polykatid antibiotics, peptide antibiotics (02L)</p> <p>4.3. Biotransformation of Steroids. (02L)</p> <p>4.4 Alcoholic beverages (Beer and Wine), Dairy products (Cheese and Yogurt) Organic acids (Vinegar and citric acid) (03L)</p> <p>4.5 Production of SCP – Yeast, Spirulina, Mushroom (01L)</p> <p>4.6 Production of Biopolymers – biogums, biopolysaccharides, bioplastic. (02L)</p> <p>4.7 Synthesis of small biological molecules, synthesis of L-ascorbic acid and Indigo. (01L)</p> <p>4.8 Application of enzymes in detergent, leather, wool industry and food, dairy industry. Production of glucose and Maltose syrup, aspartame synthesis. (02L)</p>		15 Lectures

Practicals :

USACBT5P1	Practicals based on above course in theory 1. Preparation of culture media, M9 and LB medium 2. Study of Growth curve of <i>E. coli</i> in synthetic and complex medium 3. Preparation of buffers and measurement of pH 4. Isolation of plasmid DNA from <i>E. coli</i> 5. Restriction digestion of DNA and study of restriction gene map. 6. Gel electrophoresis of DNA 7. Isolation of genomic DNA (bacterial / yeast or onion) 8. PAGE for proteins. 9. Plant Tissue culture (callus formation) 10. Western blot technique	2	60 L / Sem
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SEMESTER VI

Course Code	UNIT	TOPICS	Credits	Lec /Sem
USACBT 601		APPLIED BIOTECHNOLOGY	2	(60 Lectures)
	I	Agricultural, Animal and Plant Biotechnology 1.1 Biofertilizer, Biopesticides (04L) 1.2 Development of Insect, pathogen and herbicide resistant plants. Development of stress and senescence tolerant plants, genetic manipulation of flower pigments, Modification of plant nutrient content, Modification of food plant taste and appearance, plants as bioreactors. (06L) 1.3 Application of transgenic animals, animal bioreactors, molecular farming(pharming), cloning live stock by nuclear transfer. (05L)		15 Lecture
	II	Methodology in Animal and Plant Biotechnology 2.1 Animal cell cultures – Principles of mammalian cell culture, establishment of cell line. Continuous cell lines. Media and equipment for animal cell culture. Hybridoma technology. In vitro fertilization and embryo transfer, animal cloning, genome maps, molecular markers, Restriction fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD), variable number tandem repeats (VNTR), chromosome jumping, chromosome walking. (05L) 2.2 Transgenic animals, transfection methods, embryonic stem cell transfer, targeted gene transfer, detection of transgenic and trans gene transfer. (04L) 2.3 Plant tissue cell and organ culture- regeneration of plants, plant breeding – recombinant and non recombinant approaches, germ plasm bank. (03L) 2.4 Genetic engineering of plants, Agrobacterium mediated gene transfer, Agro infection and direct gene transfer methods, integration, inheritance analysis and confirmation of transgenic plants. (03L)		15 Lecture

	III	<p>Environmental Biotechnology</p> <p>3.1 Biological fuel generation, sources of biomass, ethanol and methane from biomass. Hydrogen production, petroleum prospecting, enhanced oil recovery. (05L)</p> <p>3.2 Bioremediation : Methods, bioremediation of hydrocarbons, dyes, paper and pulp industry, heavy metals, xenobiotics. (05L)</p> <p>3.3 Biofilters, bioaugmentation, vermicomposting and bioleaching, biosensors and biochips. (05L)</p>	15 Lecture
	IV	<p>Health Care Biotechnology</p> <p>4.1 Disease prevention – vaccines: conventional vaccines, purified antigen vaccines, recombinant vaccines. DNA vaccines, synthetic vaccines. (04L)</p> <p>4.2 Disease Diagnosis – Probes, monoclonal antibodies and detection of genetic diseases. (02L)</p> <p>4.3. Disease treatment – Products from non recombinant and recombinant organisms., interferons, growth factors, antisense nucleotides as therapeutic agents, monoclonal antibodies. (04L)</p> <p>4.4 Drug designing, pharmacogenomics, drug delivery and targeting, artificial tissue / organ, gene therapy, enzyme therapy and replacement, therapeutic proteins and blood products. (03L)</p> <p>4.5. Forensic medicine. (02L)</p>	15 Lecture

Practicals :

USACBT 6P1	<p>Practicals based on above courses in theory.</p> <ol style="list-style-type: none"> 1.Estimation of proteins by Folin – Lowry method 2. Beta – galactosidase assay 3. Demonstration of cell fusion. 4. Production of Microbial polysaccharide and determination of yield. 5. Isolation and cultivation of Azotobacter, Rhizobium, Phosphate solubilizers and preparation of biofertilizers. 6. Immobilization of <i>Saccharomyces cerevisiae</i> using alginate and invertase assay. 7. Production of Biopesticides (<i>Bacillus thuringiensis</i>) 8. Cultivation of Edible mushroom 9. Quantitation of DNA and Protein using U.V absorption 10. Transformation in bacterial cultures. 	2	60 Lec/Sem
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References

Course: USACBT501 and USACBT 601

1. R. C. Bubey. A Taxy book of Biotechnology. 2006 S. Chand and Company Ltd.
2. Bernard R Glick and Jack J Pasternak. Molecular Biotechnology: Principles and Applications of recombinant DNA. 3rd Edition.
3. B. D. Singh. Biotechnology. Kalyani Publishers.
4. S. N. Jogdand. Advances in Biotechnology. 2005. 5th Edition.
5. S. B. Primrose. Modern Biotechnology 1989. Blackwell Scientific Publ.
6. Primrose and others. Principles of Gene manipulations. 6th edition. 2004 Blackwell Science.
7. Aluizino Borent and others. Understanding Biotechnology. 2004 Pearson Education.
8. James Watson and Others. Recombinant DNA. 2001. Scientific American Books.

Modality of Assessment :

Theory Examination Pattern:

A) Internal Assessment - 40%

40 marks.

Theory

40 marks

Sr No	Evaluation type	Marks
1	One Assignment/Case study/Project	10
2	One class Test (multiple choice questions / objective)	20
3	Active participation in routine class instructional deliveries(case studies/ seminars//presentation)	05
4	Overall conduct as a responsible student, manners, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05

B) External examination - 60 %

Semester End Theory Assessment - 60%

60 marks

- i. Duration - These examinations shall be of two hours duration.
- ii. Theory question paper pattern :-
 1. There shall be **five** questions each of **12** marks. On each unit there will be one question & fifth one will be based on all the four units .
 2. All questions shall be compulsory with internal choice within the questions. Each question will be of **24** marks with options.

3. Questions may be sub divided into sub questions a, b, c & d only, each carrying **six** marks **OR** a, b, c, d,e & f only each carrying **four** marks and the allocation of marks depends on the weightage of the topic.

Practical Examination Pattern:

(A) Internal Examination:-

There will not be any internal examination/ evaluation for practicals.

(B) External (Semester end practical examination) :-

Sr.No.	Particulars	Marks
1.	Laboratory work	80
2.	Journal	10
3.	Viva	10

Semester end practical examination in applied component shall be conducted by the concerned department of the Institute/ College at the end of each semester and the marks of the candidates are to be sent to the University in the prescribed format.

Semester V:

Practical examination will be held at the college / institution at the end of the semester. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head of the Department/ Co-ordinator of the department ; failing which the student will not be allowed to appear for the practical examination.

Semester VI

Practical examination will be held at the college / institution at the end of the semester. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head of the Department/ Co-ordinator of the department ; failing which the student will not be allowed to appear for the practical examination.