

Academic Council 25/05/2011

Item No. 4.51

**UNIVERSITY OF MUMBAI**



**Syllabus for the F.Y.B.Sc.**

**Program: B.Sc.**

**Course : Biotechnology**

(Credit Based Semester and Grading System with  
effect from the academic year 2011–2012)

| <b><u>SEMESTER I (Theory) USBT101</u></b>                              |   | <b>No. of Lectures</b> | <b>No. of credit</b> |
|--|---|------------------------|----------------------|
| <b>PAPER I</b>   |   | <b>45</b>              | <b>2</b>             |
| <b>Unit – I: Microbiology</b>  |   | <b>15</b>              |                      |
| <b>Topic</b>   | <b>Subtopic</b>   |                        |                      |
| A) Nutrition, isolation cultivation and preservation of microorganisms | Nutritional requirements, Nutritional classification of microorganisms. Design of culture media, types of culture media. Concept of isolation, methods of isolation- natural microbial populations (mixed culture). Cultivation of microorganisms , Methods of enumeration, Preservation of microorganisms (Principles and method)  |                        |                      |
| B) Sterilization and disinfection                                      | i) Principle and application – methods of sterilization (physical, chemical, filtration, heat, radiation, gaseous, etc).<br>ii) Disinfection – ideal disinfectant, list of disinfectant, and their application – evaluation of disinfection (Phenol coefficient)  |                        |                      |
| <b>Unit – II: Genetics</b>   |   | <b>15</b>              |                      |
| <b>Topic</b>   | <b>Subtopic</b>   |                        |                      |
| A) Mendelian principles  | i) Segregation- Mendel's experiments, terminology, testing phenotypes, examples of gene differences and segregation.<br>ii) Independent assortment – genotypes of dihybrid crosses, testing dihybrid genotypes, crosses involving 3 -4 gene differences, correspondence between Mendelian factors and chromosome, symbols, segregation and assortment in haploid organisms. |                        |                      |
| B) Mutations and mutagenic agents                                      | Types of mutations, mutagen, types of mutagens, molecular basis of mutagenesis, reversion, induced and spontaneous mutation and silent mutation.  |                        |                      |
| <b>Unit – III: Microbial diversity and Functional Biology</b>          |   | <b>15</b>              |                      |
| <b>Topic</b>   | <b>Subtopic</b>   |                        |                      |
| A) Different groups of prokaryotes                                     | i) Archaeobacteria<br>ii) Eubacteria<br>iii) Blue green algae, Actinomycetes, Eumycota  |                        |                      |
| B) Plants  | Plant cell, types of plant tissues and their importance, organization on angiosperms and modifications of organs of commercial importance<br>Storage roots like sweet potato, carrot, beetroot, radish. Storage stems – potato, ginger, turmeric, yams, onion, garlic, <i>Acorus</i> , Fruits – Parthenocarpy<br>Seeds – (lectin) red bean                                  |                        |                      |

| <b><u>SEMESTER I (Theory) USBT102</u></b>                     |   | <b>No. of Lectures</b> | <b>No. of credit</b> |
|---|---|------------------------|----------------------|
| <b><u>PAPER – II</u></b>                                      |   | <b>45</b>              | <b>2</b>             |
| <b>Unit – I: Cell Biology</b>                                 |   | <b>15</b>              |                      |
| <b>Topic</b>  | <b>Subtopic</b>   |                        |                      |
| A) Ultra structure of prokaryotes                             | Flagella, Pili, capsule, cell wall, cell membrane, outer membrane, cytoplasm, endospores, reserve material, mesosome, nuclear material, plasmid extrachromosomal material   |                        |                      |
| B) Ultra structure of Eukaryotic cell                         | Structure of Fungal cell and Yeast – Cell wall, plasma membrane.  |                        |                      |
| <b>Unit – II: Biomolecules</b>                                |   | <b>15</b>              |                      |
| <b>Topic</b>  | <b>Subtopic</b>   |                        |                      |
| A) Chemical bonds and Role of water                           | Covalent bonds, dipoles, ionic, hydrogen bonds. Hydrophobic interaction, Vander Waals forces, functional group. Structure and properties of water, pH – pH meter, Buffers.  |                        |                      |
| B) Carbohydrates  | D & L Glyceraldehydes, structure of monosaccharide, disaccharides, and polysaccharides. Isomers of monosaccharides, chemical/physical properties of carbohydrate, chemical reactions for detection of mono., di and polysaccharides |                        |                      |
| C) Nucleic acids  | Structure, function of NA, properties and types of DNA, RNA, structure of polynucleotides   |                        |                      |
| <b>Unit – III: Medical Biotechnology</b>                      |   | <b>15</b>              |                      |
| <b>Topic</b>  | <b>Subtopic</b>   |                        |                      |
| A) Introduction to Biotechnology and its areas of application | What is biotechnology?<br>Biotechnology as an interdisciplinary pursuit.<br>Scope of biotech in various areas.<br>Public perception of biotechnology.<br>Biotechnology and the developing world.                                    |                        |                      |
| B) Host-Microbe interaction                                   | Host parasite relations, infections: sources, methods of transmission, virulence factors, basic types of clinical infections,   |                        |                      |

|   |                       |
|---|-----------------------|
| <b>SEMESTER –I (Practicals) <u>USBTP1</u></b> | <b>No. of credits</b> |
|---|-----------------------|

| <b>PAPER I</b> |  | <b>1</b> |
|----------------|--|----------|
| <b>No.</b>     | <b>Title</b>   |          |
| 1              | Study of Microscope, dark field microscope and all Lab equipments- autoclave, hot air oven, centrifuge, incubator, rotary shaker, filter assembly, LAF, pH meter |          |
| 2.             | Media preparation and sterilization –Nutrient broth/agar, Sabourauds broth/agar, MacConkeys broth/agar, Superimposed imposed blood agar-slant and plate          |          |
| 3.             | Aseptic transfer of sterile Nutrient Agar/St. Nutrient broth   |          |
| 4.             | Study of plant tissues from suitable material- parenchyma, sclerenchyma, xylem and phloem.   |          |
| 5.             | Enrichment (Allen and Chu) of algae and permanent slides of - <i>Nostoc</i> , <i>Anabaena</i> , <i>Spirullina</i> , <i>Chorella</i>                              |          |
| 6.             | Slide culture technique for Actinomycetes  |          |

|   |                       |
|---|-----------------------|
| <b>SEMESTER –I (Practicals) <u>USBTP1</u></b> | <b>No. of credits</b> |
|---|-----------------------|

| <b>PAPER II</b> |   | <b>1</b> |
|-----------------|---|----------|
| <b>No.</b>      | <b>Title</b>  |          |
| 1               | Simple staining – Monochrome stain with basic fuchin, crystal violet, malachite green, safranin.-yeast. |          |
| 2               | Differential staining – Grams staining of mixture (gram positive and gram negative)                     |          |
| 3               | Study of fungi ( <i>Aspergillus niger</i> ) and yeast.  |          |
| 4               | Special staining – capsule, cell wall, lipid, spores, nucleus   |          |
| 5               | Motility –hanging drop, stab culture.   |          |
| 6               | Qualitative tests for biomolecules – carbohydrates, lipids  |          |
| 7               | Isolation of organism from stool/feces on selective medium (Mac Conkey agar)                            |          |
| 8               | Gram staining of organism from saliva and skin.   |          |
| 9               | Extraction of Pectin from any suitable fruit.   |          |
| 10              | Staining of Starch grain from potato  |          |

|                                |            |
|--------------------------------|------------|
| <b>Total number of credits</b> | <b>2.0</b> |
|--------------------------------|------------|

| <b><u>SEMISTER II (Theory) USBT201</u></b>                   |   | <b>No. of Lectures</b> | <b>No. of credit</b> |
|--|---|------------------------|----------------------|
| <b>PAPER – I</b>   |   | <b>45</b>              | <b>2</b>             |
| <b>Unit – I: Microbiology</b>                                |   | <b>15</b>              |                      |
| <b>Topic</b>   | <b>Subtopic</b>   |                        |                      |
| A) The Microscope  | Lenses and bending of light, Simple and compound microscope, Light Microscope (Bright –field microscope) Parts of light microscope- Eye piece, objectives, condensors, numerical aperture, resolving power, Dark field microscope.  |                        |                      |
| B)Stains and Staining solution                               | Definition of dye, chromogen. Structure of dye. Chromophore and auxochrome groups. Preparation and staining of specimens, Fixation, Dyes and simple stains, Leuco compound, Monochrome staining, Mordant, Differential staining (Gram’s and Acid-fast), Romanowsky’s stain, natural dyes.                         |                        |                      |
| <b>Unit II:Genetics</b>                                      |   | <b>15</b>              |                      |
| <b>Topic</b>   | <b>Subtopic</b>   |                        |                      |
| A) Gene transfer mechanisms in bacteria                      | Transformation- Griffith’s exp. Conjugation-Davis experiment, Transduction-generalised (basic concept)  |                        |                      |
| B) Extension of genetic analysis                             | Multiple alleles-blood group, modification of dominant relationships, gene interactions, essential and lethal genes, gene expression and environment- (temperature, light, hormones)  |                        |                      |
| <b>Unit– III: Microbial diversity and Functional Biology</b> |   | <b>15</b>              |                      |
| <b>Topic</b>   | <b>Subtopic</b>   |                        |                      |
| A) Histology of mammalian tissues                            | Animal cell, tissues – epithelial tissues, connective tissues, muscular tissues, nervous tissues.   |                        |                      |
| B) Experimental models                                       | What organisms are suitable for genetic experimentation: eukaryotes and prokaryotes. Criteria for selection<br>Maintenance of <i>Drosophila</i> , Albino mice, Guinea pigs, Hamsters, Monkey, <i>Saccharomyces cerevisiae</i> , <i>neurospora crassa</i> , <i>Zea mays</i> , <i>Pisum sativum</i> , <i>E.coli</i> |                        |                      |

| <b><u>SEMESTER II (Theory) USBT202</u></b>     |   | <b>No. of Lectures</b> | <b>No. of credit</b> |
|--|---|------------------------|----------------------|
| <b><u>PAPER II</u></b>                         |   | <b>45</b>              | <b>2</b>             |
| <b>Unit– I: Cell Biology</b>                   |   | <b>15</b>              |                      |
| <b>Topic</b>                                   | <b>Subtopic</b>   |                        |                      |
| A)<br>Cytoplasmic organelles                   | Introduction to cytoplasmic organelles- Mitochondria and chloroplast.   |                        |                      |
| B)<br>Interface nucleus including (Cell cycle) | Nucleosome, biological significance of DNA, cell cycle- phases, regulation by cell growth and extra cellular signals, cell cycle check points, coupling of s phase to m phase, cell cycle progression.  |                        |                      |
| <b>Unit – II: Biomolecules</b>                 |   | <b>15</b>              |                      |
| <b>Topic</b>                                   | <b>Subtopic</b>   |                        |                      |
| A) Lipids                                      | Classification and properties, saturated, unsaturated, structure and function triacylglycerol, storage lipids, structural lipids, phospholipids, action of phospholipases, steroids.  |                        |                      |
| B) Amino acids, proteins and c0 C) Enzymes     | Structure, properties, function, and chemical reaction of amino acids, classification and structure of proteins. Silk fibroin, keratin hemoglobin and myoglobin. Structure of peptides. Titration curve of amino acids. Concept of Isoelectric pH, zwitter ion.<br>Introduction, classification, active site and enzyme specificity |                        |                      |
| <b>Unit – III: Medical Biotechnology</b>       |   | <b>15</b>              |                      |
| <b>Topic</b>                                   | <b>Subtopic</b>   |                        |                      |
| A)<br>Immunity                                 | Introduction, mechanism of innate immunity, acquired immunity, local and herd immunity. Humoral and cellular immunity.  |                        |                      |
| B)<br>Antigens and antibody                    | Determinant of antigenicity, biological classes<br>Structure, immunoglobulin classes.   |                        |                      |

| <b>SEMESTER II (Practicals) <u>USBTP2</u></b> |  | <b>No. of credit</b> |
|---|--|----------------------|
| <b>PAPER I</b>                                |  | <b>1</b>             |
| <b>No.</b>                                    | <b>Title</b>   |                      |
| 1.  | Study of minimum nutritional requirement.  |                      |
| 2.  | Isolation techniques of E.coli/ S. aureus  |                      |
| 3.  | Preservation of microorganisms – serial subculture method and paraffin oil technique.  |                      |
| 4.  | Serial dilution technique – i) Surface spread<br>ii) pour plate.   |                      |
| 5.  | Enumeration methods – haemocytometer, breeds count, opacity tube   |                      |
| 6.  | Effects of environment on bacterial growth – effect of pH, temp, osmotic pressure  |                      |
| 7.  | Study of aerobic microflora and anaerobic microflora from (cow dung) in Robertson’s cooked meat medium                                   |                      |
| 8.  | Drosophila culture-corn meal medium  |                      |
| 9.  | Mounting of Squamous and stratified epithelium   |                      |
| 10.   | Study of animal tissues from permanent slides:-blood, bone marrow, neuron, connective tissue-spongy, smooth, skeletal and heart muscles. |                      |
| <b>SEMESTER II (Practicals) <u>USBTP2</u></b> |  | <b>No. of credit</b> |
| <b>PAPER II</b>                               |  | <b>1</b>             |
| <b>No.</b>                                    | <b>Title</b>   |                      |
| 1   | Qualitative tests for biomolecules – protein, nucleic acids, amino acid  |                      |
| 2   | Amylase, urease, invertase, catalase, dihydrogenase activity (qualitative)   |                      |
| 3   | Extraction of Casein from milk.  |                      |
| 4   | Stages of Mitosis  |                      |
| 5   | Meat tenderization using papain.   |                      |
| <b>Total number of credits</b>                |  | <b>2.0</b>           |

## Distribution of Topics and Credits

### F.Y.B.Sc. Biotechnology Semester I

| Course         | Nomenclature   | Credits | Topics  |
|----------------|--|---------|---|
| <b>USBT101</b> | Microbiology, Genetics and Microbial Diversity and Functional Biology  | 02      | 1. Microbiology                               |
|                |  |         | 2. Genetics                                   |
|                |  |         | 3. Microbial Diversity and Functional Biology |
| <b>USBT102</b> | Cell Biology, Biomolecules and Medical Biotechnology   | 02      | 1. Cell Biology                               |
|                |  |         | 2. Biomolecules                               |
|                |  |         | 3. Medical Biotechnology                      |
| <b>USBTP1</b>  | Microbiology, Genetics and Microbial Diversity and Functional Biology<br>Cell Biology, Biomolecules and Medical Biotechnology Practical I & II | 02      |   |

### F.Y.B.Sc. Biotechnology Semester II

| Course         | Nomenclature   | Credits | Topics  |
|----------------|--|---------|---|
| <b>USBT201</b> | Microbiology, Genetics and Microbial Diversity and Functional Biology  | 02      | 1. Microbiology                               |
|                |  |         | 2. Genetics                                   |
|                |  |         | 3. Microbial Diversity and Functional Biology |
| <b>USBT202</b> | Cell Biology, Biomolecules and Medical Biotechnology   | 02      | 1. Cell Biology                               |
|                |  |         | 2. Biomolecules                               |
|                |  |         | 3. Medical Biotechnology                      |
| <b>USBTP2</b>  | Microbiology, Genetics and Microbial Diversity and Functional Biology<br>Cell Biology, Biomolecules and Medical Biotechnology Practical I & II | 02      |   |



## Scheme of Examination:

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks in the first part & by conducting the Semester End Examinations with 60% marks in the second part.

The Course having Practical training will have Practical Examination for 50 marks at the end of Semester, out of which 30 marks for the Practical task assigned at the time of examination. The 20 marks are allotted as Internal Assessment.

The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

**Internal Assessment:** It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the Credit based system by way of participation of learners in various academic and correlated activities in the given semester of the programme.

**Semester End Assessment :** It is defined as the assessment of the learners on the basis of Performance in the semester end Theory/ written/ Practical examination.

### Modality of Assessment :

**Internal Assessment - 40%** **40 marks.**

#### a) Theory 40 marks

| Sr No | Evaluation type   | Marks |
|-------|---|-------|
| 1     | Two Assignments/Case study/Project  | 20    |
| 2     | One class Test (multiple choice questions objective)  | 10    |
| 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) Practicals 20 marks

| Sr No | Evaluation type     | Marks |
|-------|---------------------|-------|
| 1     | Two best practicals | 10    |
| 2     | Journal             | 05    |
| 3     | Viva                | 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 four questions each of 15 marks. On each unit there will be one question & fourth one will be based on entire syllabus.
  2. All questions shall be compulsory with internal choice within the questions. Each question will be of 20 to 23 marks with options.
  3. Questions may be sub divided into sub questions a, b, c, d & e only & the allocation of marks depends on the weightage of the topic.

**Practical External Assessment**

**30 marks**

**Note:**

- A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of F.Y.B.Sc. Biotechnology or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of F.Y.B.Sc. Biotechnology as per the minimum requirements. In case of loss of journal a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However such a candidate will be allowed to appear for the practical examination but the marks allotted for the journal will not be granted.