SAURASHTRA UNIVERSITY, RAJKOT

Accredited Grade “A” by NAAC (CGPA 3.05)

COURSE STRUCTURE & SYLLABUS
FOR
UNDERGRADUATE PROGRAMME
IN
BIOTECHNOLOGY
(Faculty of Science)

[As per Choice Based Credit System (CBCS) as recommended by UGC]

Effective from June - 2016

PREFACE
Updating and revision of the Curriculum at regular interval of time is a prime criterion of IQAC – NAAC and a prime need for the college and educational systems affiliated to University.

Biotechnology is an applied subject that refers to the use of living organisms or the products of these organisms to improve human health and the human environment. It is revolutionizing the way we manufacture products and view the relationships of all living things. Although biotechnology is considered a growing science, the processes used today have their basis in the nature. These processes are used to transfer genetic materials from one cell into another by using a common bacterium. This transfer of DNA permits variance of one or several traits and confers a new property on an organism. For example, tomato plants have been made resistant to Tobacco Mosaic Virus, which can cause large crop loss.

Biotechnology has the potential to affect a number of fields and issues, including agriculture, food processing, health care, forensics, energy production, and the environment. Current applications include diagnostics, the production of vaccines and pharmaceuticals, and improved crop and livestock. The life sciences such as biotechnology, medicine, biomedical research, bioinformatics, etc.

Composition of Curriculum for a particular subject requires following criteria to be considered:

1. Guidelines and Model curriculum given by the UGC and the University
2. Regional needs
3. Present national and International trends in the subject
4. Geographical parameters of the University and its demographic property
5. Relationship with other related subjects
6. Financial and statutory provisions of the state government
7. Resources of educational needs.

The content of a syllabus should be such that it maintains continuity with the course content of higher secondary class and post graduate course. The present curriculum is made keeping this in mind and is an effort to impart fundamental knowledge of the subject needed at this level.

Chairman, Board of Studies, Biotechnology
Saurashtra University, Rajkot (Gujarat)
Date: 16-02-2016
### SAURASHTRA UNIVERSITY
#### SCIENCE FACULTY

**Subject: BIOTECHNOLOGY**

<table>
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Annexure – “C”

FACULTY OF SCIENCE

Syllabus

Subject: BIOTECHNOLOGY

Course (Paper) Name & No.: Metabolism of Biomolecules (BT-301)

Course (Paper) Unique Code: 1603 18000103 0100

External Exam Time Duration: 2.5 Hours

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<th>Semester</th>
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<th>Credit</th>
<th>Internal Marks</th>
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<td>7</td>
<td>30</td>
<td>70</td>
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Course Objective:

- To understand the fundamentals and properties of enzymes and its kinetics
- Basics and fundamentals of metabolism and various pathways associated with various biochemical reaction and its association with health and diseases
- To understand the fundamentals of membrane structure and its role in molecular transportation
- To study concept of signal transduction, role of G protein in signal transduction
- To understand importance of plant and animal hormones
### COURSE STRUCTURE FOR UG PROGRAMME
**BIOTECHNOLOGY - 301**
**SEMESTER - III**

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| Total credits | 7 | Total marks | 150 |

**General instructions**

1. The medium of instruction will be English for theory and practical courses.
2. There will be 6 lectures / week / theory paper / semester.
3. Each lecture will be of 55 mins.
4. There will be 2 practical / week / paper / batch. Each practical will be of 3 periods.
5. Each semester theory paper will be of “five” units. There will be 60 hrs. of theory teaching / paper / semester.
6. Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks with 15 marks for internal and 35 marks for external evaluation. So, Total Marks of Theory and Practical for each Paper will be 150. (100 + 50 = 150)

**SKELETON OF THEORY EXAMINATION PAPER - EXTERNAL**

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SaurashtraUniversity, Rajkot, Gujarat (INDIA)6 of 17
(SEMESTER – III)

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<td>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</td>
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<td>Short Questions - (attempt any three out of six)</td>
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<td>Answer in detail – (attempt any two out of five)</td>
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<td>5x2= 10 Marks</td>
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| Ques. 2                               |             |
| Answer specifically- (attempt any three out of six) |
| Short Questions - (attempt any three out of six) |
| Answer in detail – (attempt any two out of five) |
| Units 1 to 5                          |             |
| Units 1 to 5                          |             |
| 3x2= 6 Marks                          |             |
| Units 1 to 5                          |             |
| Units 1 to 5                          |             |
| 3x3= 9 Marks                          |             |
| Units 1 to 5                          |             |
| 5x2= 10 Marks                         |             |

General Instructions

1. Time duration of each theory paper will be of two and half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be internal option for all the questions (as shown in table above)
4. All questions are compulsory

BT-301 –METABOLISM OF BIOMOLECULES
(THEORY)
Unit-1:- ENZYME (credit-0.8)
1.1 Enzymes: - General properties, Nomenclature and Classification. Biocatalyst and Chemical Catalyst, Coenzymes, Cofactors, Isoenzyme and Allosteric Enzyme  
1.2 Catalytic Mechanism (Proximity and Orientation effects, Acid base Catalysis, Covalent Catalysis and Metal ion catalysis and Transition state analog)  
1.3 Enzyme Kinetics (derivation of Michaelis–Menten constant, linear transformation of the equation)  
1.4 Enzyme Inhibition: Mechanism and Types (Irreversible and Reversible)  
1.5 Mechanism of Enzyme Regulation: Covalent and Allosteric Regulation

UNIT-2:- METABOLISM - 1(credit-0.8)
2.1 Carbohydrate Metabolism: Glycolysis, fate of pyruvate  
2.2 Carbohydrate Metabolism: TCA  
2.3 Carbohydrate Metabolism: Gluconeogenesis and HMP  
2.4 Lipid Metabolism: β-oxidation of fatty acids  
2.5 ETC and Oxidative Phosphorylation

UNIT-3:- METABOLISM - 2(credit-0.8)
3.1 Protein Metabolism: Transamination, Decarboxylation and Deamination  
3.2 Protein Metabolism: Urea Cycle  
3.3 Biosynthesis of Nucleic Acid  
3.4 Photosynthesis  
3.5 Inborn Errors of Metabolism

UNIT-4:- HORMONES (credit-0.8)
4.1 Introduction to Hormones: Endocrine and Exocrine  
4.2 Plant Hormones and its functions  
4.3 Animal Hormones and its functions  
4.4 Types of Animal Hormones  
4.5 Disorders due to hormonal imbalance in humans

UNIT-5:- MOLECULAR TRANSPORTATION AND SIGNALING (credit-0.8)
5.1 Composition and architecture of membrane  
5.2 Solute transport across membrane  
5.3 Signal transduction cascade  
5.4 Regulation of cell cycle by protein kinase  
5.5 Role of signal transduction by hormones

LIST OF PRACTICALS
Exp.1. To demonstrate working operations of spectrophotometer.  
Exp.2. Estimation of Protein by Biuret method.  
Exp.3. Estimation of Reducing Sugar by Nelson- Somogyi method  
Exp.4. Estimation of Nucleic Acid (DNA and RNA)  
Exp. 5, 6, 7 Assaying of various enzymes (any three):
a) Amylases by KI-I2 method.
b) Phenol oxidase (Potato).
c) Phosphatases
d) Urease.
e) Invertase by GOD/POD and DNSA method.
f) Proteolytic enzymes (Trypsin or Pepsin).
g) Lipases (Germinating castor seeds).

Exp.8, 9, 10 Enzyme Kinetics:
a) Effect of Substrate concentration (Determination of Km and Vmax).
b) Effect of pH and temperature on enzyme activity
c) Effect of Enzyme inhibitors on enzyme activity

Exp. 11 One day Field visit.

LIST OF INSTRUMENTS

1. pH Meter
2. Hot Air Oven
3. Weigh Balance
4. Water Bath
5. Refrigerator
6. Autoclave
7. Spectrophotometer and/or Colorimeter
8. Incubator
9. Stirrer
10. Centrifuge
11. Vortex

LIST OF REFERENCES

5. U Satyanarayan, Biochemistry, 3rd Edn, Books and Allied Pvt. Ltd.
20. A.V.S.S. Rama Rao, A Textbook of Biochemistry, UBS Publisher
27. Practical manuals of Biotechnology, S. Chand

**P.S. The above reference book list are common for all the unit**

Annexure – “C”
FACULTY OF SCIENCE

Syllabus

Subject: BIOTECHNOLOGY

Course (Paper) Name & No.: Environmental Biotechnology and Biostatistics (BT-401)

Course (Paper) Unique Code: 1603 1800 0104 0100

External Exam Time Duration: 2.5 Hours

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<td>30</td>
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Course Objective:

- To bring the awareness about environment and use of biotechnology to solve problems related to biodiversity and pollution
- To understand the fundamentals of terrestrial and marine ecosystem
- To understand the concept of biodegradation and role of bacteria in metabolism of xenobiotics
- To study the properties of waste water and techniques to treat waste water
- To study concepts of statistics and its applications in the biotechnology
COURSE STRUCTURE FOR UG PROGRAMME
BIOTECHNOLOGY- 401
SEMESTER-IV

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Total credits: 7
Total marks: 150

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4. There will be 2 practical / week / paper / batch. Each practical will be of 3 periods
5. Each semester theory paper will be of “five” units. There will be 60 hrs. of theory teaching / paper / semester.
6. Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks with 15 marks for internal and 35 marks for external evaluation. So, Total Marks of Theory and Practical for each Paper will be 150. (100 + 50 = 150)

SKELETON OF THEORY EXAMINATION PAPER -EXTERNAL
(SEMESTER –IV)

<table>
<thead>
<tr>
<th>SECTION – I</th>
<th>Marks – 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</td>
<td></td>
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<tr>
<td>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</td>
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<table>
<thead>
<tr>
<th>SECTION – II</th>
<th>Marks – 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Que.1 Answer specifically- (attempt any three out of six)</td>
<td>Units 1 to 5</td>
</tr>
<tr>
<td>Short Questions - (attempt any three out of six)</td>
<td>Units 1 to 5</td>
</tr>
<tr>
<td>Answer in detail – (attempt any two out of five)</td>
<td>Units 1 to 5</td>
</tr>
</tbody>
</table>

Que.2 Answer specifically- (attempt any three out of six) | Units 1 to 5 | 3x2= 6 Marks |
| Short Questions - (attempt any three out of six) | Units 1 to 5 | 3x3= 9 Marks |
| Answer in detail – (attempt any two out of five) | Units 1 to 5 | 5x2= 10 Marks |

General Instructions

1. Time duration of each theory paper will be of two and half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be internal option for all the questions (as shown in table above)
4. All questions are compulsory

BT-401–ENVIRONMENTAL BIOTECHNOLOGY AND BIOSTATISTICS
(THEORY)

Unit 1:- Ecosystem and its component (credit-0.8)

1.1 Terrestrial Biomes: - Deserts, Grasslands, Tundra & Forests and Aquatic Biomes: Freshwater & Saline Ecosystem
1.2 Biogeochemical Cycles: Nitrogen, Carbon & Sulfur cycle
1.3 Biodiversity: - Factors affecting biodiversity, Biodiversity conservation
1.4 Interaction within, between & among populations
1.5 Population Ecology, Population characteristics, Models of population growth and Interactions

Unit 2:- Environmental pollutions and its remedies (credit-0.8)

2.1 Diversity of metabolic processes among bacteria
2.2 Overview:Biodegradation of Hydrocarbon & Xenobiotics
2.3 Biodegradation of DDT, Nitrobenzene
2.4 An overview of process of Bioremediation&Biomagnification
2.5 Conventional Air Pollutants & Acid rain & Acid mine drainage

Unit 3:- Microbial Application in Environment (credit-0.8)

3.1 Physical, Chemical & Biological properties of water and waste-water
3.2 Primary, Secondary and Tertiary treatment processes
3.3 Treatment of solid wastes (Anaerobic digestion and composting)
3.4 Biofertilizers and Biocontrol
3.5 Bioleaching and Bioplastics

Unit 4: - Biostatistics - 1(credit-0.8)

4.1 Scope and applications of Biostatistics
4.2 Samples and population concept, Collection, Processing and Presentation of data
4.3 Frequency distribution
4.4 Measures of Central tendency- Arithmetic, Harmonic and Geometric Mean, Mode and Median, their applications, merits and demerits
4.5 Measures of dispersion- Range, Variance, Standard Deviation, Coefficient of Variance, their applications, merits and demerits

UNIT: - 5 Biostatistics - 2(credit-0.8)

5.1 Correlation analysis and Regression analysis: Linear, Bivariate regression analysis
5.2 Probability and Conditional probability, Theoretical distributions-Binomial and Poisson distribution and their Properties; Normal distribution and its properties, Skewness and kurtosis
5.3 Student’s t-test- introduction and application in biology
5.4 Chi square test- introduction and application in biology
5.5 Analysis of variance- introduction and application in biology

LIST OF PRACTICALS
Exp. 1. Physical parameters of waste water (Color, Turbidity, Odor, pH, TS, TDS and TSS estimation)
Exp. 2. $\text{NH}_4$-N Estimation
Exp. 3. $\text{NO}_2$-N Estimation and $\text{NO}_3$-N Estimation
Exp. 4. Chloride Estimation
Exp. 5. Ca-Mg Hardness
Exp. 6. Phosphorus Phosphate Estimation
Exp. 7. Dissolved oxygen (DO)
Exp. 8. Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)
Exp. 9. Bacteriological analysis by MPN technique
Exp. 10. Biostatistics examples:
   a. Calculation of Mean, Standard Deviation and Coefficient of Variance
   b. Frequency distribution graphs and curves
   c. Value of confidence limit for the population mean
   d. Significant test: Student’s $t$-test for paired and unpaired data
   e. Chi-square test
   f. Analysis of variance (ANOVA) - Randomized Block Design (RBD)
   g. Regression coefficient and Correlation coefficient
Exp. 11. One day Field visit

**LIST OF INSTRUMENTS**

1. pH Meter
2. Hot Air Oven
3. Weigh Balance
4. Water Bath
5. Refrigerator
6. Incubator
7. BOD Incubator
8. Autoclave
9. UV Spectrophotometer and Colorimeter
10. COD Apparatus
11. Incubator
12. Stirrer
13. Vortex

**LIST OF REFERENCES**

4. Saras Publication, Biostatistics applications
6. Manoj Tiwari & Kapil Khulbe, Environmental studies, IK International
8. H.R. Singh, Environmental Biology, S. Chand Pub.
13. K. Omasa, Pollution & Plant Biotechnology, Springer IntEdn
14. InduShekhar Thakur, Environmental Biotechnology, IK International
15. William P. Cunningham, Environmental Science, McGraw Hill
16. Pradipta Kumar Mohapatra, Textbook of Environmental Biotechnology, IK Int.
17. A. Mackenzie, Instant notes in Ecology, Viva books Pvt Ltd
18. Rajvaidhya, Environmental Biochemistry, APH Pub
20. Bitton, Wastewater Microbiology - 2 ed, Wiley
21. Purohit Shammi, Environmental Sciences, Student Edi
22. Eugene Odum, Ecology, Oxford
23. Gerba & Pepler, Environment microbiology
25. APHA. Water and Wastewater analysis.


P.S. The above reference book list are common for all the unit