SYLLABUS

FOR

B.Sc. SEMESTER PATTERN IN

BIOTECHNOLOGY VI TH SEMESTER

GONDWANA UNIVERSITY

GADCHIROLI

INDIA

SESSION 2014-2015
1. There shall be total six Semesters. Total 3000 Marks.
2. The Division / Grade of the student shall be calculated on the basis of Science subjects as per the previous yearly pattern.
3. Each semester shall comprise of 90 teaching days.
4. Semester I and II shall be of 600 Marks
5. Semester III to IV shall be of 450 Marks
6. Semester V to VI shall be of 450 Marks
7. Biotechnology subject in each semester will comprise of
   a. Two theory papers – 50 Marks each
   b. One internal assessment based on two theory papers for 10 Marks each. Total 20 Marks.
   c. One practical / Laboratory work – Total 30 marks
8. In addition to above Semester I and II will have
   a. One compulsory English paper of 60 marks with 15 marks internal assessment.
   b. One second language paper (Supp Eng / Hindi / Marathi / Urdu / etc) of 60 Marks with 15 marks internal assessment.
9. The Internal assessment shall be conducted by the University approved teachers in the relevant subjects.
10. The internal assessment shall be done by the respective college one month prior to the final exam of each semester. The Marks shall be sent to the university immediately after the internal assessment is over.
11. The pattern of Internal assessment and guidelines for the same shall be prepared by the respective subject Board of Studies
12. All Theory papers shall be divided into four units. Each unit shall be covered in 7.5 hours.
13. The theory question papers shall be of 3 hours duration and comprise of 5 questions with internal choice and with equal weightage to all units. (as per the previous pattern)
14. Practical exam shall be of 8 hours duration for one day.
15. Table of teaching and examination scheme attached.
## Teaching & Examination Scheme

### Bachelor of Science

### Three Year (SIX SEMESTER) DEGREE COURSE

### B. Sc. Part III (Semester V and VI)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject</th>
<th>Teaching scheme</th>
<th>Examination scheme</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Theory</td>
<td>Practical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Th + Tu</td>
<td>Pr</td>
</tr>
<tr>
<td>1</td>
<td>Biotechnology</td>
<td>Paper I - Genetic Engineering</td>
<td>3+@</td>
</tr>
<tr>
<td>2</td>
<td>Biotechnology</td>
<td>Paper II - Plant Biotechnology</td>
<td>3+@</td>
</tr>
<tr>
<td>3</td>
<td>Practical</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Biotechnology</td>
<td>Paper I - Environmental Biotechnology</td>
<td>3+@</td>
</tr>
<tr>
<td>5</td>
<td>Biotechnology</td>
<td>Paper II - Animal Biotechnology</td>
<td>3+@</td>
</tr>
<tr>
<td>6</td>
<td>Practical</td>
<td>-</td>
<td>6</td>
</tr>
</tbody>
</table>

**Grand Total of Semester V &VI: 450 each semester = TOTAL - 450 Marks per semester**

Note: Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment; @ = Tutorials wherever applicable; * = If required, for two days.
Paper -I Environmental Biotechnology

**Unit 1- Introduction to Environmental Problems**
A. Environmental education- Problems and need.
B. Environmental pollution: classification of pollutants
C. Water pollution- water pollutants- organic, inorganic, microbial, radioactive, eutrophication,
D. Air pollution- sources and pollutants.
E. Ozone depletion, green-house effect and acid rain

**Unit 2- Water Pollution and Waste water treatment**
A. Waste water: composition, types
B. Measurement of water pollution- BOD (Biochemical oxygen demand), COD (chemical oxygen demand)
C. Waste water treatment: classification, types (flow sheet)
D. Biological waste water treatment: activated sludge, trickling filter, oxidation pond, rotating biological contactor, anaerobic digester.
E. Treatment scheme of industries: paper and sugar industries

**Unit 3- Xenobiotics, Biodegradation and Bioremediation**
A. Basic concept of xenobiotics, types
B. Bioaccumulation and biomagnification
C. Biodegradation of xenobiotics in environment: degradative plasmids, Biodegradation of hydrocarbons, surfactant, pesticides, synthetic dyes
D. Bioleaching of heavy metals: Copper, mercury, advantages and disadvantages of bioleaching.

**Unit 4- Biofertilizer, Bioenergy and Pest Management**
A. Biogeochemical cycles: - (nitrogen, carbon and sulphur)
B. Biofuel: alcohol
C. Biological nitrogen fixation- symbiotic and non-symbiotic nitrogen fixation, mechanism, Role of rDNA technology in nitrogen fixation.
D. Biofertilizers- bacterial biofertilizers, algal biofertilizers, fungi as biofertilizers (VAM)
E. Biopestisides: Examples and integrated pest management(IPM)
B.Sc. Biotechnology  
Semester-VI

Paper –II Animal Biotechnology

Unit 1- Basics of Animal Cell Culture
- A. Concept of animal cell culture
- B. Various systems of animal tissue culture, advantages and limitations.
- C. Culture media: Natural media, synthetic media, balanced salt solutions.
- D. Chemical, physical and metabolic functions of different constituents of culture medium, role of CO₂, serum and supplements.
- E. Characteristics of cells in culture: contact inhibition, anchorage dependence, cell-cell communication.

Unit 2- Methods of Animal Tissue Culture
- A. Isolation of cells: various methods of separation of cell types
- B. Primary culture: behavior of cells, properties
- C. Explant culture; suspension culture.
- D. Established cell line cultures: definition, maintenance and management; cryopreservation, germplasm conservation

Unit 3- Developmental Techniques in Animal Cell Culture
- A. Apoptosis: measurement of cell death. apoptosis (death domain, role of cytochrome C)
- B. Cell transformation, cell cloning
- C. Cell synchronization and cell manipulation
- E. Stem cell cultures, embryonic stem cells and their applications.
- F. Three dimensional cultures

Unit 4- Application of Animal Tissue Culture
- A. Mass production of biologically important compounds- vaccines, insulin
- B. Manipulation of reproduction in animals: artificial insemination, embryo transfer in human
- C. In vitro fertilization technology: embryo cloning and embryonic stem cell.
- D. Transgenic animals- mice, large animals( sheep)
PRACTICALS

Environmental and Animal Biotechnology

1. Development of primary cell lines/maintenance of established cell lines.
2. *Determination of chemical oxygen demand (COD) of sewage sample.
3. *Production of microbial fertilizers (Rhizobium/Azotobacter/VAM).
4. Determination of total dissolved solids of water.
5. *Determination of hardness and alkalinity of water sample.
6. Determination of dissolved oxygen concentration of water sample.
8. Isolation of xenobiotic degrading bacteria by selective enrichment technique.
9. Test for the degradation of aromatic hydrocarbons by bacteria.
10. Preparation and formulation of microbial biopesticide (bacteria, fungi).
11. Effect of mycorrhizal fungi on growth promotion of plants.
12. Preparation of animal cell culture media.
15. Microphotography.

Note:
1. Underlined experiments are treated as major experiments.
2. Students should perform atleast 4 major and 6 minor experiments.
3. Practicals with asteric mark are compulsory.
4. An educational tour is strongly recommended.
5. For project a suitable microbial investigation involving laboratory work or survey work may be given to 1-3 students at the beginning of semester.
6. Report on project / review work preferably printed should be submitted duly certified by incharge teacher and head of the department.

Distribution of marks during semesterwise practical examinations of B.Sc. III (Semester VI)

1. One major experiment- 08
2. Two minor experiment- 2 X 4= 08
3. Project (lab or review work) 06
4. Viva voce- 4
5. Practical record- 4

Total 30

Duration of exam will be 8 hrs. on a day.
TEXT BOOKS & REFERENCES FOR THEORY AND PRACTICALS FOR B.Sc. semester VI:

1. ENVIRONMENTAL MICROBIOLOGY BY: RALPH MITCHELL, JOHN WILEY AND SOPS, INC.
2. ENVIRONMENTAL BIOTECHNOLOGY BY: C.F. FROSTER AND D.A. JOHN WASE, ELIS HORWOOD.
3. BIOCATALYSIS AND BIODEGRADATION: MICROBIAL TRANSFORMATION OF ORGANIC COMPOUNDS BY: LAWRENCE P. WACEKETT.
4. A MANUAL OF ENVIRONMENT MICROBIOLOGY BY: CHRISTON J. HURST, ASM PUBLICATION.
5. BIODEGRADATION AND BIOREMEDIATION ACADEMIC PRESS BY: SAN DIEGO.
6. BIOTECHNOLOGY IN THE SUSTAINABLE ENVIRONMENT, PLENUM PRESS, NY BASIC PRINCIPLES OF GEOMICROBIOLOGY BY: A.D. AGATE.
7. ENVIRONMENTAL MICROBIOLOGY BY: R.M. MAIER, I.C. APPER AND C.P. GERBA.
8. METHODS IN MICROBIOLOGY, LYNCH AND HOBBIE.
9. EXPERIMENTAL MICROBIAL ECOLOGY BY: AROSISON ACADEMIC PRESS.
10. ADVANCES IN APPLIED MICROBIOLOGY BY: D. PEARLMAN ACADEMIC PRESS.
11. MICROBIOLOGY OF EXTREME ENVIRONMENTS, EDITED BY CLIVE EDWARD, OPEN UNIVERSITY PRESS, MILTON KEYNES.
12. ENVIRONMENTAL SCIENCE WORKING WITH THE EARTH BY: MILLER.
13. MICROBIAL BIOTECHNOLOGY, PRINCIPLES AND APPLICATIONS BY: LEE YUAN KUN.
14. MICROBIAL BIOTECHNOLOGY, FUNDAMENTALS OF APPLIED MICROBIOLOGY BY: ALEXANDER N. GLAZER, HIROSHI NIKAI DO.
15. TEXTBOOK OF ORGANIC MEDICINAL AND PHARMACEUTICAL CHEMISTRY BY: JAIME N. DELGADO WILLIAM A. REMERS.
16. MICROBIAL ECOLOGY BY LYNCH ET AL.
17. EXPERIMENTAL MICROBIAL ECOLOGY BY BURNS ET AL.
18. SOIL MICROBIOLOGY (2006) BY N.S. SUBBA RAO OXFORD & IBH PUBLISHING CO.PVT. LTD.
19. INTRODUCTION TO SOIL MICROBIOLOGY (1961) BY MARTIN ALEXANDER, JOHN WILEY & SONS , INC. NEW YORK , LONDON.
20. MICROBIAL ECOLOGY (1993) BY RONALD M. ATLAS AND RICHARD BARTHA.
22. BIOTECHNOLOGY (E.H.), B. D. SINGH, 2008, KALYANI PUBLICATION.
23. CELL BIOLOGY GENETICS MOLECULAR BIOLOGY EVOLUTION AND ECOLOGY, P. S. VERMA, 2005, S.CHAND.
24. INDUSTRIAL BIOTECHNOLOGY, THAKUR.
33. EXPERIMENTAL BIOTECHNOLOGY, MADHAV SHARMA, NIRMAL TRIPATR, CRESCENT PUB CORPORATION, 2008.
34. ANIMAL CELL CULTURE, JOHN R. W. MASTERS, OXFORD UNI. PRESS NEW YORK, 2000.
35. BIOCHEMICAL METHODS, SADASHIVAM, 2006.