

**SYLLABUS**

**FOR**

**B.Sc. SEMESTER PATTERN IN**

**BIOTECHNOLOGY**

**SEMESTER - IV**

**GONDWANA UNIVERSITY**

**GADCHIROLI**

**INDIA**

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**Gondwana University, Gadchiroli**  
**Teaching & Examination Scheme**  
**Bachelor of Science**  
**Three Year (SIX SEMESTER ) Degree course**

**BIOTECHNOLOGY**

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 II (Semester III and IV)**

S. No.		Subject	Teaching scheme			Examination scheme										
			Th + Tu (Periods)	Pr (Periods)	Total Periods	Theory					Practical					Total Marks / credits (Th, Pr, IA)
			Duration Hrs	Max Marks Th paper	Min Passing Marks Th	Max Marks Int Assessment	Min Passing IA	Total	Min passing Marks	Duration Hrs	Max marks practical	Min passing marks				
1	Semester-III	Biotechnology Paper I- Cell Metabolism	3+@	-	6+@	3	50	18	10	4	120	22	-	-	-	150
2		Biotechnology Paper II- Molecular Biology and Enzymology	3+@	-		3	50	18	10	4		22	-	-	-	
3		Practical	-	6		6	-	-	-	-		-	-	6-8*	30	
4	Semester-IV	Biotechnology Paper I- Biophysical Techniques	3+@	-	6+@	3	50	18	10	4	120	22	-	-	-	150
5		Biotechnology Paper II- Immunology and Biostatistics	3+@	-		3	50	18	10	4		22	-	-	-	
6		Practical	-	6		6	-	-	-	-		-	-	6-8*	30	
<b>Grand Total of Semester III &amp; IV: 450 each semester = TOTAL - 450 Marks per semester</b>																

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

## **B.Sc. Biotechnology Semester-IV**

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### **Paper -I Biophysical Techniques**

#### **Unit-I Spectrophotometry**

- A. Concept of electromagnetic radiation, spectrum of light absorption of electromagnetic radiations, involvement of orbital in absorption of electromagnetic radiations.
- B. Concept of chromophores.
- C. Concept of Lambert and Beer's law
- D. Difference between spectrophotometer and colorimeter.
- E. Instrumentation and applications of UV and visible Spectrophotometry.

#### **Unit-II Chromatography**

- A. Partition principle, partition coefficient, brief account of paper chromatography.
- B. Thin layer chromatography
- C. Gel filtration-concept of distribution coefficient, types of gels and glass beads, applications.
- D. Ion-exchange chromatography-Principle, types of resins, choice of buffers, applications including amino acid analyzer.
- E. Affinity chromatography-Principle, selection of ligand, brief of ligand attachment.

#### **Unit-III Electrophoresis and Centrifugation**

- A. **Electrophoresis**- Migration of ions in electric field, factors affecting electrophoretic mobility,
- B. Gel electrophoresis-Types of gels, solubilizers, procedure, column, slab gels and submarine electrophoresis, detection.
- C. SDS-PAGE electrophoresis- applications
- D. **Centrifugation**- Basic principles, concept of RCF,
- E. Preparative centrifugation- Differential and density gradient centrifugation.
- F. Analytical centrifugation- Sedimentation coefficient,

#### **Unit-IV Isotopic Tracer Technique**

- A. Radioactive and stable isotopes, rate of radioactivity decay, units of radioactivity
- B. Measurement of radioactivity- Ionization chamber, proportional counters, Geiger-Muller counter, solid and liquid scintillation counter (Principle, instrumentation and techniques),
- C. Measurement of stable isotopes- Falling drop method for deuterium, Mass spectrometry
- D. Principle of tracer techniques, advantage and limitations, Application of isotopes in biotechnology (distribution studies, metabolic studies, autoradiography)

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## **B.Sc. Biotechnology** **Semester-IV**

### **Paper –II Immunology and Biostatistics**

#### **Unit-I Basics of Immunology**

- A. Historical background
- B. Concept of Immunity and their classification
- C. Cells of Immunity- Lymphocytes, Granulocytes and Agranulocytes.
- D. Organs of Immunity- Primary lymphoid organs (Bone marrow, Thymus), Secondary lymphoid organs (Spleen, Lymph node)
- E. Immunoglobulin and their classes

#### **Unit-II Immune Response**

- A. Innate Immunity
- B. Humoral Immunity
- C. Cell mediated Immunity- ADCC, Complement system
- D. MHC-I and MHC-II molecules
- E. Hypersensitivity- Delayed type hypersensitivity
- F. Vaccination- Discovery, Principle and their significance
- G. Concept of autoimmunity

#### **Unit-III Immunological Techniques**

- A. Antigen-antibody reactions- Precipitation, agglutination, complement fixation, toxin-antitoxin reaction
- B. Radial immunodiffusion, ELISA, VDRL and widal.
- C. Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnosis.

#### **Unit-IV Biostatistics**

- A. Measures of central tendency: mean, mode, and median.
- B. Measures of dispersion: range, mean deviation, standard deviation.
- C. Methods of sampling, sampling error, non-sampling errors, standard error.
- D. Chi-square test, meaning of correlation and regression.
- E. Presentation of statistical data: tabulation (simple tables, frequency distribution table); charts and diagrams (bar charts, histograms, pie charts, dendrogram).

## B.Sc. Biotechnology Semester-IV

### PRACTICALS

#### Biophysical Techniques, Immunology and Biostatistics

1. Gel electrophoresis of proteins.
2. \*Agarose gel electrophoresis of nucleic acid.
3. \*SDS-PAGE of an oligomeric protein.
4. Determination of absorption spectrum of oxy- and deoxyhaemoglobin.
5. Spectrophotometric titration of proteins.
6. Protein estimation by E280/E260 method.
7. \*Paper chromatography of amino acids/sugars.
8. TLC of lipid/amino acids.
9. Antigen- antibody reactions: blood group (demo only), pregnancy (demo only) and widal (quantitative).
10. \*Radial immunodiffusion.
11. \*ELISA
12. Cellular fractionation and separation of cell organelles using centrifuge.
13. \*Calculation of mean, median and mode (manual / computer aided)
14. Calculation of standard deviation and standard error (manual / computer aided).
15. Biostatistical problem based on standard deviation.
16. Computer presentation of statistical data, chart and diagrams.

#### Note: -

1. **Underlined practicals are considered as major practicals.**
2. **Practicals with asteric mark are compulsory practicals.**
3. **At least 8 practical to be carried out in a semester.**
4. **The theory involved with each practical must be taught before conducting the practical.**

#### Distribution of marks during semesterwise practical examinations of B.Sc. II (Semester IV)

1. One major experiment-	10
2. Two minor experiment-	2 X 5= 10
3. Viva voce-	5
4. Practical record-	5
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Total	30

**Duration of exam will be 8 hrs. on a day**

**TEXT BOOKS & REFERENCES FOR THEORY AND PRACTICALS FOR B.Sc.  
semester IV:**

1. BIOTECHNOLOGY, B. D. SINGH, KALYANI PUBLICATION, LUDHIANA, 2008
2. CELL AND MOLECULAR BIOLOGY, GERALD KARP, WILEY PUB., 2007
3. BIOTECHNOLOGY A LAB. MANUAL, JEFFERY M. BECKER, ACADEMIC PRESS, 1998
4. IMMUNOLOGY, KUBY, W.H.FREEMAN AND COMPANY, 2007
5. BIOLOGICAL INSTRUMENTATION AND METHODOLOGY, P.K.BAJPAI, S.CHAND, 2008
6. TEXT BOOK OF BIOTECHNOLOGY, R.C.DUBEY, S.CHAND, 2009
7. TEXT OF IMMUNOLOGY AND IMMUNOTECHNOLOGY, B.ANNADURAI, S.CHAND, 2008
8. INTRODUCTION TO BIOPHYSICS, PRANAB K.BANERJEE, S.CHAND, 2008
9. ENCYCLOPEDIA OF BIOSTATISTICS VOL-I, D.UPRETTI, R.P.RASTOGI, DOMINANAT PUBLISHERS, 2008
10. ENCYCLOPEDIA OF BIOSTATISTICS VOL-II, D.UPRETTI, R.P.RASTOGI, DOMINANAT PUBLISHERS, 2009
11. ENCYCLOPEDIA OF BIOSTATISTICS VOL-III, D.UPRETTI, R.P.RASTOGI, DOMINANAT PUBLISHERS, 2009
12. ENCYCLOPEDIA OF BIOSTATISTICS VOL-IV, D.UPRETTI, R.P.RASTOGI, DOMINANAT PUBLISHERS, 2009
13. ENCYCLOPEDIA OF BIOSTATISTICS VOL-V, D.UPRETTI, R.P.RASTOGI, DOMINANAT PUBLISHERS, 2009
14. ENCYCLOPEDIA OF IMMUNOLOGY VOL-I, SURENDRA NAHA,RABINDRA NARAIN, DOMINANAT PUBLISHERS, 2009
15. ENCYCLOPEDIA OF IMMUNOLOGY VOL-II, SURENDRA NAHA,RABINDRA NARAIN, DOMINANAT PUBLISHERS, 2009
16. ENCYCLOPEDIA OF IMMUNOLOGY VOL-III, SURENDRA NAHA,RABINDRA NARAIN, DOMINANAT PUBLISHERS, 2009
17. ENCYCLOPEDIA OF IMMUNOLOGY VOL-IV, SURENDRA NAHA,RABINDRA NARAIN, DOMINANAT PUBLISHERS, 2009
18. ENCYCLOPEDIA OF IMMUNOLOGY VOL-V, SURENDRA NAHA,RABINDRA NARAIN, DOMINANAT PUBLISHERS, 2009
19. ENCYCLOPEDIA OF IMMUNOLOGY VOL-VI, SURENDRA NAHA,RABINDRA NARAIN, DOMINANAT PUBLISHERS, 2009
20. ENCYCLOPEDIA OF IMMUNOLOGY VOL-VII, SURENDRA NAHA,RABINDRA NARAIN, DOMINANAT PUBLISHERS, 2009
21. TOOLS AND TECHNIQUES OF BIOTECHNOLOGY, MADHAV SHARMA, NIRMAL TRIPATR, CRESCENT PUB CORPORATION, 2008
22. BIOSTATISTICS, WAYNE W. DINIEL, WILEY INDIA, 2007
23. BIOPHYSICAL CHEMISTRY, UPADYAY, NATH, HIMALAYA PUBLISHING HOUSE, 2009
24. PRINCIPLE OF TECHNIQUES, KEITH WILSON, JOHN WALKER, CAMBRIDGE UNI. PRESS, 2008
25. ROITT'S ESSENTIAL IMMUNOLOGY, PETER J. DELVES, BLAKWELL PUBLISHING, 2006
26. TECHNIQUES IN LIFE SCIENCES, DR. D. B. TEMBHARE, HIMALAYA PUBLICATION, 2006
27. BIOPHYSICS, PRANAVKUMAR CHATTERJI, S. CHAND, 2008