

SYLLABUS

FOR

M.Sc. SEMESTER IV PATTERN IN

BIOTECHNOLOGY

GONDWANA UNIVERSITY

GADCHIROLI

INDIA

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**SYLLABUS
FOR
M.Sc. SEMESTER PATTERN IN BIOTECHNOLOGY SUBJECT, GONDWANA UNIVERSITY
GADCHIROLI (M.S.) INDIA**

SEMESTER – I (THEORY)

			MARKS
PAPER - I	BT1-T001	CELL BIOLOGY	80
PAPER - II	BT1-T002	MICROBIOLOGY	80
PAPER - III	BT1-T003	BIOPHYSICAL TECHNIQUES	80
PAPER - IV	BT1-T004	MOLECULAR BIOLOGY	80

PRACTICALS

PRACTICAL - I	BT1-LAB1		80
PRACTICAL - II	BT1-LAB2		80
SEMINAR /	BT1-INT1		25
JOURNAL CLUB /ASSIGNMENTS EACH THORY PAPER			20

SEMESTER – II (THEORY)

			MARKS
PAPER - I	BT2-T005	ENZYMOLGY	80
PAPER - II	BT2-T006	IMMUNOLOGY AND IMMUNOLOGICAL TECHNIQUES	80
PAPER - III	BT2-T007	MOLECULAR BIOLOGY AND BIOINFORMATICS	80
PAPER - IV	BT2-T008	INDUSTRIAL BIOTECHNOLOGY	80

PRACTICALS

PRACTICAL - III	BT2-LAB3		80
PRACTICAL - IV	BT2-LAB4		80
SEMINAR /	BT2-INT2		25
JOURNAL CLUB /ASSIGNMENTS EACH THORY PAPER			20

SEMESTER – III (THEORY)

			MARKS
PAPER - I	BT3-T009	ANIMAL BIOTECHNOLOGY	80
PAPER - II	BT3-T010	PLANT BIOTECHNOLOGY	80
PAPER - III	BT3-T011	GENETIC ENGINEERING	80
PAPER - IV	BT3-T012	APPLIED BIOTECHNOLOGY	80

PRACTICALS

PRACTICAL - I	BT3-LAB5		80
PRACTICAL - II	BT3-LAB6		80
SEMINAR /	BT3-INT3		25
JOURNAL CLUB /ASSIGNMENTS EACH THORY PAPER			20

SEMESTER – IV (THEORY)

			MARKS
PAPER - I	BT4-T013	ENVIRONMENTAL BIOTECHNOLOGY	80
PAPER - II	BT4-T014	APPLIED ENVIRONMENTAL BIOTECHNOLOGY AND ECOLOGY	80
PAPER - III	BT4-T015	ETHICS, PATENTING AND BIO-ENTREPRENEURSHIP	80
PAPER - IV	BT4-T016	RESEARCH METHODOLOGY AND BIOSTATISTICS	80

PRACTICALS AND PROJECT WORK

PRACTICAL - I BT4-LAB7
 PROJECT WORK BT4-
 SEMINAR / BT4-INT1
 JOURNAL CLUB /ASSIGNMENTS EACH THEORY PAPER

80
 100
 25
 20

APPENDIX A

MASTER OF SCIENCE (BIOTECHNOLOGY)

TWO YEAR (FOUR SEMESTERS) DEGREE COURSE

Sr.No	Semester	Paper	Course code	Title of paper	Teaching scheme			Examination scheme							
					T (hr)	P (hr)	Total Periods /week	Dur. Of paper (Hrs.)		Max. Marks		Min. Pass Marks		Total Marks / Credits	
								T	P	T	P	T	P	T	P
1	I	I	BT1-T001	Cell Biology	4		4	3		75		30		75/4	
2	I	II	BT1-T002	Microbiology	4		4	3		75		30		75/4	
3	I	III	BT1-T003	Biophysical Techniques	4		4	3		75		30		75/4	
4	I	IV	BT1-T004	Molecular Biology	4		4	3		75		30		75/4	
5	I		BT1-LAB1	Laboratory Exercise 1		8	8		8*		90		36		90/4
6	I		BT1-LAB2	Laboratory Exercise 2		8	8		8*		90		36		90/4
7	I		BT1-INT1	Seminar / Journal Club / Assignments	2		2			20			08	20/1	
8				Total	18	16	34			320				320/ 17	180/ 8
9	II	I	BT2-T005	Enzymology	4		4	3		75		30		75/4	
10	II	II	BT2-T006	Immunology and Immunological techniques	4		4	3		75		30		75/4	
11	II	III	BT3-T007	Molecular Biology and Bioinformatics	4		4	3		75		30		75/4	
12	II	IV	BT2-T008	Industrial Biotechnology	4		4	3		75		30		75/4	
13	II		BT2-LAB3	Laboratory Exercise 3		8	8		8*		90		36		90/4
14	II		BT2-LAB4	Laboratory Exercise 4		8	8		8*		90		36		90/4
15	II		BT2-INT2	Seminar / Journal Club / Assignments	2		2			20			08	20/1	
16				Total	18	16	34			320				320/ 17	180/ 8

Sr.No	Semester	Paper	Course code	Title of paper	Teaching scheme			Examination scheme							
					T (hr)	P (hr)	Total Periods /week	Dur. Of paper (Hrs.)		Max. Marks		Min. Pass Marks		Total Marks / Credits	
								T	P	T	P	T	P	T	P
1	III	I	BT3-T009	Animal Biotechnology	4		4	3		75		30		75/4	
2	III	II	BT3-T010	Plant Biotechnology	4		4	3		75		30		75/4	
3	III	III	BT3-T011	Genetic Engineering	4		4	3		75		30		75/4	
4	III	IV	BT3-T012	Applied Biotechnology	4		4	3		75		30		75/4	
5	III		BT3-LAB5	Laboratory Exercise 5		8	8		8*		90		36		90/4
6	III		BT3-LAB6	Laboratory Exercise 6		8	8		8*		90		36		90/4
7	III		BT3-INT3	Seminar / Journal Club / Assignments	2		2			20			08	20/1	
8				Total	18	16	34			320				320/ 17	180/ 8
9	IV	I	BT4-T013	Environmental Biotechnology	4		4	3		75		30		75/4	
10	IV	II	BT4-T014	Applied Environmental Biotechnology and Ecology	4		4	3		75		30		75/4	
11	IV	III	BT4-T015	Ethics, Patenting and Bio-Entrepreneurship	4		4	3		75		30		75/4	
12	IV	IV	BT4-T016	Research Methodology and Biostatistics	4		4	3		75		30		75/4	
13	IV		BT2-LAB7	Laboratory Exercise 7		8	8		8*		90		36		90/4
14	IV		BT4	Project Work		8	8		8*		90		36		90/4
15	IV		BT4-INT4	Seminar / Journal Club / Assignments	2		2			20			08	20/1	
16				Total	18	16	34			320				320/ 17	180/ 8

Note: T= Theory; P= Practical/lab, * = If required, for two days.

Minimum marks for passing 32 out of 80 in each Theory paper

Minimum marks for passing 40 out of 100 in each Practical/lab and Project work and minimum of 08 out of 20 in the internal (journal club/assignment) examination of that semester.

Minimum marks for passing 10 out of 25 in seminar

APPENDIX B
MASTER OF SCIENCE (BIOTECHNOLOGY)
TWO YEAR (FOUR SEMESTERS) DEGREE COURSE

A) Pattern of Question Paper

1. Four units in each paper.
2. One question on each unit.
3. Fifth question on all units.
4. Maximum marks of each paper 80
5. Projects shall be evaluated by internal and external examiners. 50% marks of project shall be given by internal and external examiners each.
6. Duration of question paper is 3 hours.
7. Practical/lab examination of 80 marks. Distribution of marks shall be 40 internal and 40 external. Internal practical/lab of 20 marks.

General Instructions/Directions.

Each paper is supposed to cover minimum 60 clock hours of teaching and 240 clock hours per semester for all the four papers.

Each Question paper shall have five questions with equal marks/credits.

There will be four long questions one question from each unit. A long question can be subdivided into two short questions.

Fifth question shall comprise of four very short question one question of each unit.

There shall be internal choice from each unit.

Practical examination shall be of minimum 12 hours and may spread over two days,

There shall be at least one major and two minor experiments in the practical examination

Minimum passing marks are per the marks/credit annexure.

Every student shall be required to participate in educational/industrial tour atleast once during PG course.

M. Sc. Biotechnology Semester IV

Paper I- Environmental Biotechnology

Unit 1 Global Environmental Problems

- A. Environmental education, Need for environmental education.
- B. Environmental Pollution: Classification of pollutants.
- C. Air pollution- air quality, sources and pollutants
- D. Water pollution- types of water pollution, water pollutants (organic, inorganic, microbial and radioactive), eutrophication.
- E. Ozone depletion, green-house effect and acid rain.

Unit 2 Interaction of Environmental Components

- A. Ecosystem structure and functions, abiotic and biotic component.
- B. Ecological Pyramids-types.
- C. Biotechnological processes: bioconversion, bioaccumulation, bioconcentration, biomagnification, and biodegradation.
- D. Degradation of xenobiotics in environment: decay behavior and degradative plasmids

Unit 3 Bioresources and Bioenergy

- A. Biogeochemical cycles: - (nitrogen, carbon, phosphorous and sulphur)
- B. Need for Bioresources
- C. Bio-Energy: non conventional or renewable sources of energy
- D. Energy from biomass: petroleum plants, alcohol, biogas and hydrogen.
- E. Biochips, biofilters, biofuel cells and their uses.

Unit 4 Soil Fertility and Pest Management

- A. Biological nitrogen fixation- symbiotic and non-symbiotic nitrogen fixation, mechanism, *nif* gene, role of rDNA technology in nitrogen fixation.
- B. Biofertilizers- bacterial biofertilizers, algal biofertilizers, fungi as biofertilizers
- C. Biopesticides and Integrated pest management:

M. Sc. Biotechnology Semester IV

Paper II- Applied Environmental Biotechnology, Ecology

Unit 1 Measurement of Water Pollution

- A. Waste water: composition, types
- B. Measurement of water pollution (BOD- biological oxygen demand, COD- chemical oxygen demand)
- C. Detection of pathogenic organism: laboratory methods (MTF, MFT)
- D. Techniques to detect fecal from non-fecal bacteria: IMViC test

Unit 2 Waste Water Treatment

- A. Waste water treatment: classification, types
- B. Biological waste water treatment: aerobic, anaerobic, activated sludge, trickling filter, rotating biological contactor, anaerobic digester.
- C. Waste water treatment by biofilms.
- D. Treatment scheme of industries: dye, pulp and paper, petroleum, dairy, distillery, tannery, sugar industries.

Unit 3 Biodegradation and Bioremediation

- A. Xenobiotics in environment: biodegradation of hydrocarbons, surfactant, pesticides, lignin, tannin, synthetic dyes,
- B. Bioabsorption and bioleaching of heavy metals: cadmium, lead, mercury, metal binding targets, advantages and disadvantages of bioleaching.
- C. Biomethylation of elements (methylation of mercury and arsenic)
- D. Genetic aspects of heavy metal resistance in cyanobacteria and fungi.

Unit 4 Ecology

- A. Mineral resources and their conservation-terrestrial mineral resources.
- B. Ecological aspects of mining.
- C. Biodiversity- biotechnological methods of conservation, cryopreservation.
- D. Forest conservation- forest cover, deforestation, afforestation (protective and exploitative forestry)
- E. Wildlife management- tiger reserve in India

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Paper III- Ethics, Patenting and Bio-Entrepreneurship

Unit 1 Ethics and sustainable development

- A. Ethics: benefits of biotechnology
- B. Recombinant therapeutic products for human health care.
- C. Genetic modifications and food consumption,
- D. Release of genetically engineered organisms,
- E. Applications of human genetic rDNA research, human embryonic stem cell research.
- F. Environmental legislation, quality control in biotechnology.

Unit 2 Patenting and Biosafety

- A. Patenting: patent and trademark,
- B. Intellectual property rights, plant breeders rights,
- C. Biotechnology in developing countries.
- D. Biotechnology products and processes,
- E. Biosafety and its implementation,
- F. Quality control in biotechnology.

Unit 3 Bio-Entrepreneurship-I

- A. Concept of bio-entrepreneurship: definition, pillars of bio-entrepreneurship, factors necessary for entrepreneurship, desirable in startup.
- B. Pillars of bio-entrepreneurship, promoting bio-entrepreneurship
- C. Biotech company roadmap- biofertilizer company
- D. Legal regulatory and other business factors for entrepreneurship

Unit 4 Bio-Entrepreneurship-II

- A. Funding of biotech business- financing, funding of biotech business in India, exit strategy, licensing strategies, and valuation.
- B. Bio-entrepreneurship effort in India, difficulties, funding agencies in India, biotech policy initiatives.
- C. Role of knowledge center- universities and research institutes, role of technology and upgradation.

M. Sc. Biotechnology Semester IV

Paper IV- Research Methodology and Biostatistics

Unit 1 Introduction to Research Methodology

- A. Introduction of Research
- B. Objective of Research
- C. Motivation in Research
- D. Steps in Research Process
- E. Research Design: Concepts and Type of research design
- F. Design of research on the basis of application – pure and applied

Unit 2 Direction to Research Methodology

- A. Design of research on the basis of methodology – exploratory and descriptive
- B. Descriptive research – qualitative and quantitative.
- C. Quantitative – Field studies (field experiments and laboratory experiments)
- D. Sampling and data collection: techniques of sampling (random, stratified, systematic, multistage)
- E. Primary and secondary sources of data

Unit 3 Introduction to Biostatistics

- A. Methods of sampling, sampling error, non-sampling errors, standard error.
- B. Measures of central tendency: mean, mode, and median.
- C. Measures of dispersion: range, mean deviation, standard deviation.
- D. Probability.

Unit 4 Application of Biostatistics in Research

- A. Chi-square test, meaning of correlation and regression.
- B. Cluster analysis: phylogenetic clustering by simple matching coefficients.
- C. Presentation of statistical data: tabulation (simple tables, frequency distribution table); charts and diagrams (bar charts, histograms, pie charts, dendrogram).

M. Sc. Biotechnology Semester IV

Practical VII (ENVIRONMENTAL BIOTECHNOLOGY, PATENTING, RESEARCH METHODOLOGY AND BIOSTATISTICS)

Compulsory Practical

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of chemical oxygen demand (COD) of sewage sample.
3. Production of microbial fertilizers (*Rhizobium/Azotobacter*).
4. Preparation of research proposal and presentation.

Optional Practical

1. Determination of total dissolved solids of water
2. Determination of hardness and alkalinity of water sample.
3. Determination of dissolved oxygen concentration of water sample
4. Determination of biological oxygen demand of sewage sample
5. Calculation of mean, mode, and median.
6. Calculation of standard deviation and standard error.
7. Determine the efficiency of removal of air pollutant using fibrous air filter.
8. Isolation of xenobiotic degrading bacteria by selective enrichment technique
9. Test for the degradation of aromatic hydrocarbons by bacteria
10. Survey of degradative plasmids in microbes growing in polluted environment
11. Estimation of heavy metals in water/soil by Atomic absorption spectrophotometry,
12. Estimation of nitrate in drinking water.
13. Preparation and formulation of microbial biopesticide (bacteria, fungi)
14. Effect of *mycorrhizal* fungi on growth promotion of plants.
15. Preparation of proposal for patenting.
16. Determination of percentage of green house gases in environment.

Note: In addition to the 4 compulsory practicals, at least 6 optional practicals must be conducted within the semester.

TEXT BOOKS & REFERENCES FOR THEORY AND PRACTICALS:

1. EXPERIMENTS IN MICROBIOLOGY, PLANT PATHOLOGY AND BIOTECHNOLOGY, K.R. ANEJA, 2003, NEW AGE INT.PVT.LTD
2. CELL BIOLOGY GENETICS MOLE BIOLOGY EVOLUTION AND ECOLOGY, P. S. VERMA, 2005, S. CHAND
3. BIOTECHNOLOGY (E.H.), B. D. SINGH, 2008, KALYANI PUBLICATION
4. BIOTECHNOLOGY, U. SATYANARAYAN
5. ENVIRONMENTAL BIOTECHNOLOGY BY INDU SHEKHAR THAKUR
6. STANDARD METHDS OF BIOCHEMICAL ANALYSIS, THIMMAIAH, KAYANI PUBLICATION
7. CELL BIOLOGY, GENETICS, MOLE.BIOLOGY, EVOLUTION AND ECOLOGY BY P.S.VARMA
8. T.B. OF ENVIRONMENTAL MICROBIOLOGY BY P.K.MOHAPATRA
9. ENCYCLOPEDIA OF BIostatISTICS VOL-I BY D.UPRETI
10. ENCYCLOPEDIA OF BIostatISTICS VOL-II BY D.UPRETI
11. ENCYCLOPEDIA OF BIostatISTICS VOL-III BY D.UPRETI
12. ENCYCLOPEDIA OF BIostatISTICS VOL-IV BY D.UPRETI
13. ENCYCLOPEDIA OF BIostatISTICS VOL-V BY D.UPRETI
14. INTRODUCTION TO BIostatISTICS BY P.BANERGEE
15. PRACTICAL MICROBIOLOGY BY R.C.DUBEY
16. LAB MANUAL IN BIOCHEMISTRY BY J. JAYRAMAN
17. BIOCHEMICAL METHODS BY S.SADASIVAM
18. RESEARCH METHODOLOGY BY C.R. KOTHARI

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M. Sc. BIOTECHNOLOGY (Semester IV)

DISSERTATION/PROJECT WORK SCHEME/GUIDELINES FOR THE STUDENTS, SUPERVISORS AND EXAMINERS:

Every student is required to carry out Experimental/Field Based Project Work (this is in lieu of practical II of semester IV) on a related research topic of the subject/course. It must be an original work and must indicate some degree of experimental work. On the basis of this work, student must submit the project Report 9 typed and properly bound) in two copies at least one month prior to commencement of the final Practical/lab examination of Semester IV. The project report shall comprise of Introduction, Material and Methods, Result, Discussion, Summary, conclusion and, Reference along with declaration by candidate that the work is original and not submitted to any other University or Organization for award of degree and certificate by the supervisor and forwarded through head/Course-coordinator/Director of the Department/Centre or the principle of the college.

The topic for project work will be assigned to the student by supervisor at the beginning of third semester. The topic will be forwarded to the controller of examination by the head of the department.

The project Work will carry total 100 marks and will be evaluated by both external and internal examiner in the respective Department/Center/Affiliated College.

Project must contain following subsection:-

Introduction, Aim and objective, short literature review, material and methods, experiments and results, discussion, conclusion and references.

50% marks each shall be evaluated by external and internal examiner respectively.

For Project work:	80 Marks
For Viva-Voce:	20 Marks

Total :	100 Marks