GONDWANA UNIVERSITY

GADCHIROLI

CHOICE BASE CREDIT SYSTEM (CBCS)
SYLLABUS FOR

B.Sc. II Year

IN

BIOTECHNOLOGY

From

Academic Year

2018-2019

Preface

The graduate and master program in "Biotechnology" is a scientific-biological study course, based on fundamental research with special focus on biotechnology at its full diversity. This covers phylogeny, physiology, cell and molecular biology of organisms from all three domains of life. The program "Biotechnology" at the Gondwana-University is directed towards the education of excellent, competitive graduates with a great spectrum of methodology, interdisciplinary focus and international qualification for the assignment in research, and in companies. The close connection to the local job market allows an optimal change to occupation. Here, the potential of biology and in particular of molecular biology with focus on microbiology is increasingly used as platform for the networking of other disciplines. The combination and development of technology platforms of various institutes (e.g. proteome, transcriptome, metabolome analyses, chemical, biochemical, physical and cell biological analytics, fermentation) under, “Enabling Technologies" allows a strong focusing on research during the Master study program.

The Graduate and Master Study program "Biotechnology" builds consecutively on a biological education and is focused on research. The study program is especially dedicated to the integration and consolidation of knowledge in microbiology. The job market for biotechnologists is still excellent.

Dr. Abhay B. Solunke
Chairman of Board of Studies in Biotechnology
Gondwana University, Gadchiroli. (Maharashtra)
www.unigug.org

Preamble

The B.Sc. Biotechnology courses are running in Gondwana University, Gadchiroli from its beginning followed the semester pattern and now Gondwana University, Gadchiroli, has adopted the CBCS (Choice Base Credit System) pattern that would be divided B.Sc. into three years- year I, year II and year III. Each part would consist of two semesters. Each semester would comprise of four theory papers including practical's. The new course hascommenced from the academic session 2017-18. The syllabus has been prepared keeping in view the unique requirements of B.Sc. Biotechnology students. The contents have been drawn to accommodate the widening horizons of the Biotechnology discipline. It reflects the changing needs of the students, pertaining to the fields of Chemistry, Statistics and Computational skills. The detailed syllabus for each paper is appended with a list of suggested readings.

Each practical batch should not have more than 16 students. Any number exceeding 20 will be divided into two equal batches. This is because Biotechnology practicals require individual attention for imparting correct and adequate hands – on training to the students. One short educational trip will be conducted to industry/national/research institutes in the 5th semester to keep the students abreast with latest developments in the field of Biotechnology.

Approved by: Board of Studies in Biotechnology, in meeting held on 12-07-2018.

Dr. Abhay B. Solunke

Chairman

Shri Govindrao Munghate Arts & Science College, Kurkheda.

Members Present:

1. Dr. P.H. Kumbhare Guru Nanak College, Ballarshah.
2. Dr. P.S.Katkar, Guru Nanak College, Ballarshah.
3. Dr. P.S. BorkarSardar Patel Mahavidyalaya, Chandrapur.
4. Dr. V.S. Wadhai,Sardar Patel Mahavidyalaya, Chandrapur.

Table

Semester No.	Paper No.	Course Code	Title of Paper	Theory	Internal assessment	Marks
		B.Sc. Second Year				
III	VII		**Cell Metabolism**	40	10	50
	VIII		**Molecular Biology and Enzymology**	40	10	50
	IX		Practical's based on theory paper VII & VIII	30	20	50
IV	X		**Biophysical Techniques**	40	10	50
	XI		**Immunology and Biostatistics**	40	10	50
	XII		Practical's based on theory paper X & XI	30	20	50

SEMESTER-III

B.Sc. II

Semester III		
Course Code…….	**Paper-VII Marks: 40**	
Credits: 2	**Total Hours :48**	
Cell Metabolism		
Objective: To make the students to understand the fundamentals of physiological and metabolic pathways.		
Unit No.	**Content**	**Hrs.**
1	**Bioenergetics** A. Concept of free energy, entropy, enthalpy and redox potential. B. Concept of high energy bonds as related to the structure of phosphoenolpyruvate, creatine phosphate etc. C. ATD-ADP cycle D. Energy charge (Phosphate potential) and its relation to metabolic regulation.	**12**
2	**Carbohydrate Metabolism** A. Cellular respiration, glycolysis (pathway, its regulation and inhibitors) B. Glyconeogenesis (bypass reaction) C. TCA cycle and its regulation, & energetics. D. Electron transport chain-ATP synthesis, oxidative phosphorylation E. Photophosphorylation, Hill reaction, CO_2 fixation F. Glycogenesis and glycogenolysis	**12**
3	**Lipid Metabolism** A. Biosynthesis of fatty acids, fatty acid synthase complex B. Oxidation of fatty acids, α, β and ω C. Ketogenesis, ketosis and ketoacidosis D. Diseases of fat metabolism- Gaucher's disease, Tay-Sachs disease, Niemann Pick disease, Fabry's disease	**12**
4	**Metabolism of Nitrogenous Compound** A. Trasamination (Mechanism) B. Urea cycle- detail account, linkage of urea cycle and TCA cycle, regulation C. Metabolic disorders of urea cycle D. Transmethylation and decarboxylation, physiological important products of decarboxylation E. Biosynthesis of purine and pyrimidines	**12**

B.Sc. II

Semester III		
Course Code ……Paper-VIII	**Marks: 50**	
Credits: 2	**Total Hours :48**	
Molecular Biology and Enzymology		
Objective: To make the students to understand the fundamentals of Molecular biology and enzymology.		
Unit No.	**Content**	**Hrs.**
1	**Introduction to the Enzymology** A. Terminology- Active site, holoenzyme, apoenzyme, substrate, coenzyme,cofactor, inhibitor, activator, modulator, allosteric enzyme, isoenzyme,ribozyme B. Concept of activity, specific activity, turnover number, unit of enzymeactivity (Katal, international unit) C. Nomenclature and classification of enzyme D. Mechanism of action- Activation energy, Lock and Key model (Fischer's template theory), Koshland model (Induce fit model)	**12**
2	**Enzyme Catalysis** A. Mechanism of enzyme catalysis- Acid base catalysis, covalent catalysis,metal ion catalysis B. Enzyme kinetics- Michaelis-Menten equation, Lineweaver- Burke plot C. Enzyme inhibition- Reversible inhibition, irreversible inhibition, D. Factors affecting enzyme activity- concentration of enzyme, concentration ofsubstrate, effect of temperature, effect of pH, temperature quotient E. Enzyme immobilization	**12**
3	**Replication and Transcription in Prokaryotes** A. **Replication-** Enzymology of replication DNA polymerase I, brief treatment of pol II and III, helicases, topoisomerases, single strand binding proteins,primase. B. Proof for semiconservative replication, Okazaki fragments, C. Replication origins, initiation, elongation and termination. D. **Transcription-** Concept of promoter (-10 and -35 sequences and theirsignificance) E. RNA polymerase F. Four steps of transcription (promoter binding and activation, RNA chain initiation, and promoter escape, chain elongation, termination and release). G. Regulation of Transcription in Prokaryotes: Basic idea of lac- and trpoperons.	**12**
4	**Genetic Code and Translation in Prokaryotes** A. General characteristics of Genetic code B. Codon- anticodon interaction –the wobble hypothesis. C. Selection of initiation codon – Shine-Dalgarno sequence and the 16S r RNA. D. Protein synthesis: - Initiation, elongation and termination. E. Concept of Couple transcription-translation.	**12**

Practicals B. Sc. II Semester III { based on Paper -VII & VIII}

Total Hours: 48 **CREDITS: 2** **Marks: 30**

1. *Isolation of RNA from bacteria.
2. *Determination of Vmax and Km for α-amylase.
3. Effect of different concentration of metal ions on activity of α-amylase enzyme.
4. Effect of pH on enzyme activity.
5. Assay of activity of β-galactosidase.
6. Isolation of mitochondria and assay of marker enzyme.
7. Isolation and determination of concentration of photosynthetic pigments from spinach leaves.
8. Estimation of free fatty acids by titration method.
9. *Effect of substrate concentration on enzyme activity.
10. Determine the heat of reaction (Enthalpy).
11. *Immobilization of enzyme in alginate gel.
12.Production microbial enzyme (amylase) and conversion of starch to glucose and detection of formed glucose by anthrone method.
13.Demonstration of genetic code.

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

1. CELL BIOLOGY GENETICS MOLE BIOLOGY EVOLUTION AND ECOLOGY BY P. S. VERMA, S. CHAND COMPANY, 2005
2. BIOCHEMISTRY BY C.B. POWAR HIMALAYA PUBLICATION, 2006
3. BIOCHEMISTRY BY J. L. JAIN, S. CHAND COMPANY, 2005
4. PRINCIPLE OF BIOCHEMISTRY (LEHNINGER) BY D. L. NELSON, REPLIKA PRESS, 2008
5. PRINCIPLE OF BIOCHEMISTRY BY D.J. VOET & C. W. PRATT, JOHN WILEY AND SONS PUBL., 2008
6. BIOCHEMISTRY, U.SATYANARAYANA, BOOKS AND ALLIED PUBL., 2011
7. BIOCHEMICAL METHOS BY S. SADASIVAM AND A. MANICKAM, NEW AGE INT. PVT. PLB., 2010
8. LABORATORY MANUAL IN BIOCHEMISTRY BY J. JAYARAMAN, NEW AGE INT. PVT , 2011
9. STANDARD METHODS OF BIOCHEMICAL ANALYSIS BY S. R. THIMMAIAH, KALYANI PUBLICATION, 2009
10. ELEMENTARY BIOCHEMISTRY, J.L.JAIN,SANJAI JAIN, 2007, S.CHAND
11. QUALITATIVE TEST AND QUANTITATIVE PROCEDURES IN BIOCHEMISTRY, PUSHPA SUNDARARAJ,ANUPA SIDHU, 1995, S.CHAND
12. BIOCHEMISTRY- A.C. DEB, 1998, NEW CENTRAL BOOK AGENCY, CALCUTTA.
13. BIOCHEMISTRY- STRYER, 6TH EDI., FREEMAN PUBLICATION.
14. BIOCHEMISTRY- PAWAR AND CHATWAL, 2005.HIMALAYA PUBLICATION HOUSE.
15. PLANT BIOTECHNOLOGY-PRACTICAL MANUAL, C.C.GIRI,ARCHANA GIRI, I.K.INT.PUB HOUSE,2007
16. BIOCHEMISTRY, MATHEWS VAN HOLDDE,AHERN, PEARSON EUD., 2005
17. AN INTRODUCTION TO PRACTICAL BIOCHEMISTRY, DAVID T. PLUMMER, TATA MCGRAW HILL, 2008
18. BIOCHEMISTRY AND MOLECULAR BIOLOGY OF PLANTS , BUCHANAN,CRUISSEN JONES, I.K.INT.PUB HOUSE, 2007

19. ANALYSIS OF AMINO ACID OF PROTEINS AND NUCLEIC ACID, BUTTERWORTH,HEINEMANM,OPEN UNIVERSITY PUBL, 2004
20. GENERAL ENZYMOLOGY, KULKARNI & DESHPANDE, HIMALAYA PUBLICATION
21. INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS, CHATWAL & ANAND, HIMALAYA PUBLICATION
22. ENZYMOLOGY & ENZYME TECHNOLOGY, S. M. BHATT, S. CHAND
23. BIOCHEMISTRY, TREHAN , KESHAR, NEW AGE PUBLICATION
24. ENZYMES, TREVOR PALMER, AFFILIATED EAST-WEST PRESS PVT. LTD.
25. PRINCIPALS OF CELLS ENERGETICS, BUTTERWORTH,HEINEMANM, OPEN UNIVERSITY PUBL,2004
26. PRINCIPLES OF ENZYMOLOGY FOR TECHNOLOGICAL APPLICATION,BUTTERWORTH,HEINEMANM, OPEN UNIVERSITY PUBL, 2004
27. GENETICS BY C. B. PAWAR, HIMALAYA PUBLICATION, 2008
28. MICROBIAL TECHNOLOGY OF TCA. A.B.SOLUNKE, V.S.HAMDE, P.S.WAKTE.LAMBERT PUBLISHERS GERMANY.

SEMESTER-IV

B.Sc. II

Semester-IV		
Course Code ……Paper-XMarks: 50		
Credits: 2		**Total Hours :48**
Biophysical Techniques		
Objective: To make the students to understand the fundamentals Techniques.		
Unit No.	**Content**	**Hrs.**
1	**Spectrophotometry** A. Concept of electromagnetic radiation, spectrum of light absorption ofelectromagnetic radiations, involvement of orbital in absorption ofelectromagnetic 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.	**12**
2	**Chromatography** A. Partition principle, partition coefficient, brief account of paperchromatography. B. Thin layer chromatography C. Gel filtration-concept of distribution coefficient, types of gels and glassbeads, 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.	**12**
3	**Electrophoresis and Centrifugation** A. **Electrophoresis**- Migration of ions in electric field, factors affectingelectrophoretic mobility, B. Gel electrophoresis-Types of gels, solubilizers, procedure, column, slab gelsand 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,	**12**
4	**Isotopic Tracer Technique** A. Radioactive and stable isotopes, rate of radioactivity decay, units ofradioactivity 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, Massspectrometry D. Principle of tracer techniques, advantage and limitations, Application ofisotopes in biotechnology (distribution studies, metabolic studies,autoradiography)	**12**

B.Sc. II

Semester-IV		
Course Code ……Paper-XIMarks: 50		
Credits: 2		**Total Hrs :48**
Immunology and Biostatistics		
Objective: To make the students to understand the fundamentals of the **Immunology and Biostatistics.**		
Unit No.	**Content**	**Hrs.**
1	**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	**12**
2	**Immune Response** A. Innate Immunity B. Humaral 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	12
3	**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.	12
4	**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 stastical data: tabulation (simple tables, frequency distribution table); charts and diagrams (bar charts, histograms, pie charts, dendogram).	12

Practicals B. Sc. II
(Semester IV)
{based on Paper -X & XI}

Total Hours: 48 **CREDITS: 2** **Marks: 30**

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) andwidal (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.

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 INSTUMENTATION 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