

NORTH MAHARASHTRA UNIVERSITY
JALGAON



'A' Grade
NAAC Re-Accredited
(3rd Cycle)

SYLLABUS FOR

Second Year Bachelor of Science

in

Biotechnology

(S.Y. B.Sc. Biotechnology Semester Pattern)

w. e. f. Academic Year 2016 - 2017

North Maharashtra University, Jalgaon.

Syllabus for S.Y. B.Sc. Biotechnology (Semester Pattern)

(w. e. f. Academic Year 2016 - 17)

Course Structure at a Glance

Course Title	Semester	Marks		Credits
		Ext.	Int.	
BT - 231: Cell Biology and Metabolism	I	60	40	03
BT - 232: Molecular Biology	I	60	40	03
BT - 233: Practical Course in Biotechnology – I	I	60	40	1.5
BT - 241: Biophysics	II	60	40	03
BT - 242: Immunology and Bioprocess Technology	II	60	40	03
BT - 243: Practical Course in Biotechnology – II	II	60	40	1.5

- Each theory course is divided into four units and is to be completed in 60 periods (lectures) of 45 minutes duration each.
- Each course (theory and practical) will have 04 periods (lectures) per week.
- Practical examination for each semester will be held at the end of the respective semester.
- A Study tour of minimum one day is compulsory. Students should submit tour report at the time of practical examination.

BT – 231: Cell Biology and Metabolism

Unit – I: Cell division and Cell transport

(20 lectures; 20 marks)

- Cell cycle process: G1, S, G2 and M Phases.
- Cell division: Mitosis and Meiosis and its comparison
- Structure and organization of cell membrane
- Membrane transport: Active and Passive
- Membrane models: Bilayer and Danielli-Davson model
- Transport by vesicle formation: Endocytosis and Exocytosis.

Unit – II: Basic Enzymology

(20 lectures; 20 marks)

- Concept and terminologies in enzymology
- General properties of enzymes
- Enzyme nomenclature and classification with example
- Mechanism of enzyme catalysis: Lock and key, Induced fit
- Concept of enzyme activity and specific activity
- Concept of allosteric enzymes
- Factors affecting on enzyme activity:
- Enzyme concentration, Substrate concentration, pH, Temperature, Activators and Inhibitors
- Concept and types of Enzyme Inhibition

Unit – III: Metabolic pathways

(20 lectures; 20 marks)

- Concept of Metabolism: Catabolism and Anabolism
- Catabolic pathways, energetics and regulation of: Glycolysis, TCA cycle, Fatty acid degradation: - oxidation
- Anabolic pathways and regulation of: Gluconeogenesis, Glycogenesis.
- Protein metabolism: Transamination and Deamination

Recommended Books:

1. Fundamentals of Enzymology by Price. N.C., Stewens Levis, 3rd edition
2. Elementary Microbiology by Modi. H.A, Vol I; Akta Publication, Nadiad
3. Lehninger's Principles of Biochemistry (2000) by Nelson D.L. and Cox M.M., CBS Publications.
4. Cell Biology (1989) by Pawar C.B., Himalaya Pub. House, Mumbai
5. Harper's Biochemistry by Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W., Appleton and Lange, Stanford, Connecticut.
6. Biochemistry by Satyanarayana U., Books and Allied (P) Ltd, Kolkata.

BT – 232: Molecular Biology

Unit – I: Genome organization and Prokaryotic DNA replication (20 lectures; 20 marks)

- Concept of Gene, Genome, Chromosome, Cistron, Muton, Recon, Introns and Exons.
- Organization of Chromatin, Histone and Non-histone proteins.
- Nature and Properties of Genetic Code.
- Prokaryotic DNA replication: Enzymes and proteins involved
- Mechanism of Replication: Initiation, Elongation, synthesis of Leading and lagging strands, Termination.

Unit – II: DNA Damage and Repair (20 lectures; 20 marks)

- Mutation concept: Types of mutations, Spontaneous mutation and Induced mutation
- Mutagens: Physical mutagens and Chemical mutagens
- DNA repair mechanisms: Photoreactivation and Dark excision repair

Unit – III: Transcription, Translation and Regulation (20 lectures; 20 marks)

- Transcription: RNA polymerase, Initiation, Elongation and Termination.
- Inhibitors of transcription.
- Translation: Role of Ribosome, Activation of amino acids, Initiation, chain Elongation and termination of translation.
- Inhibitors of translation
- Concept of Operon
- Promoter, Operator, Structural and Regulatory genes.
- Model of Lactose operon: Structure, Positive and Negative regulation

Recommended Books:

1. Concepts in Molecular Biology by Rastogi S.C., New Age International (P) Ltd, New Delhi.
2. Concepts in Molecular Biology (2001) by Verma P.S. and Agrawal V.K., S. Chand and Co. Ltd, New Delhi.
3. Molecular Biotechnology by Pasupuleti Mukesh, MJP (P), Chennai.
4. Gene Regulation by Powar C.B, Himalaya Book Pvt. Ltd, Mumbai.
5. Cell and Molecular Biology by Lohar P.S., MJP Publishers, Chennai.
6. Basics of Molecular Biology by Friefilder D., Barlett Publications.
7. Genetics (1995) by Strickburger M.W., Practice Hall of India Pvt Ltd, New Delhi.
8. Basic Molecular Biology by A. Upadhyay and K. Upadhyay, Himalaya Publishing House, Mumbai.

BT - 241: Biophysics

Unit – I: Spectrophotometry

(20 lectures; 20 marks)

- Concept of electromagnetic radiations, Absorption spectrum, Beer-Lambert's law and its limitations.
- Basic concept of chromophore and auxochrome.
- Principle, instrumentation and applications of UV and visible spectrophotometry : Single beam, Double beam and Dual wavelength
- Concept of atomic absorption spectroscopy.

Unit – II: Chromatography

(20 lectures; 20 marks)

- Chromatography: Stationary and mobile phases, Concept of partition coefficient and nature of partition forces.
- Principle, methodology and applications of: Paper, Thin layer, Ion exchange, Affinity and Molecular exclusion chromatography
- Concept of modern chromatography techniques: HPLC.

Unit – III: Electrophoresis

(20 lectures; 20 marks)

- Electrophoresis: Concept and Principle, Types : Free and Zonal electrophoresis
- Principle, methodology and applications of: Paper electrophoresis, Agarose gel electrophoresis and SDS PAGE
- Isoelectric Focussing

Recommended Books:

1. Biophysical chemistry: Principles and Techniques (2003) by Upadhyay, Upadhyay and Nath, Himalaya Publishing House, Mumbai.
2. Essentials of Biophysics by Narayanan P., New Age Publishers.
3. Physical Biochemistry by Friefelder D., 2nd Edition, W. H. Freeman and Co.
4. Biophysical Chemistry: Principles and Techniques by Singh Ayodhya and Singh Ratnesh, Campus Books, New Delhi.
5. Practical Biochemistry: Principles and Techniques (2000) Keith Wilson and Walker John, Cambridge University Press.

BT - 242: Immunology and Bioprocess Technology

Unit – I: Basics of Immunology

(20 lectures; 20 marks)

- Introduction to immune system
- Properties of immune system: Specificity, Diversity, Self v/s non-self-discrimination
- Types of immunity: Innate and Acquired
- Cellular and Humoral immune responses

Unit – II: Antigen and Antibody

(20 lectures; 20 marks)

- Concept and Types of antigen, Antigenic determinants, Hapten
- Antigen and Immunogen, antigenicity and Immunogenicity
- Factors affecting antigenicity
- Structure, types and functions of Immunoglobulin

Unit – III: Basics of Bioprocess Technology

(20 lectures; 20 marks)

- Concept and significance of bioprocess technology
- Screening : Primary and Secondary
- Preservation of industrially important micro-organisms : Storage at reduced temperature and storage in dehydrated form
- Culture collection and culture collection Centers:
 - National: NCIM, MTCC
 - International: ATCC
- Concept of Bioreactor
- Design of Fermenter: The key considerations
- Types of fermentation process: Batch and Continuous

Recommended Books:

1. Immunology by Singh Bharat, Pointer Pub, Jaipur.
2. Immunology by Yadav P.R., Discovery Pub House, New Delhi.
3. Fundamentals of Immunology (1989) by Coleman R.M, Lombard M.F, Sicard R.E., Rencocca N.J., W.C. Brown Pub.
4. Principles of Fermentation Technology by Stanburi P.F., Whitakar & Hall S.J., 2nd Edition.
5. Industrial Microbiology by Cassida L.E. Jr, New Age Int Publishers.
6. A Textbook of Microbiology by Dubey R.C. and Maheshwari D.K., S. Chand Publication, New Delhi.
7. Industrial Microbiology by Patel A.H., Mac Millon India Ltd.
8. A Textbook of Biotechnology by Dubey R.C., S. Chand & Co. Ltd., New Delhi.
9. Immunology (2007) by I. Kannan, MJP Publishers, Chennai.
10. Basic Immunology by I. Shastri, Himalaya Publications, Nagpur.

BT – 233: Practical Course in Biotechnology – I

1. Determination of cell size by micrometry (Yeast/Bacterial cell)
2. Study of mitotic cell division by squash method (Onion root tip)
3. Study of meiotic cell division (*Triadiscantia* buds)
4. Estimation of DNA by DPA method
5. Estimation of RNA by Orcinol method
6. Determination of enzyme activity of acid / alkaline phosphatase
7. Determination of effect of pH on enzyme activity
8. Determination of effect of temperature on enzyme activity
9. Isolation of mutants by replica plate method

BT – 243: Practical Course in Biotechnology – II

1. Verification of Beer's law
2. Determination of λ_{max} by using a suitable dye
3. Separation of amino acids by paper chromatography
4. Separation of sugar / amino acid by thin layer chromatography
5. Study of ethanol production by using *Saccharomyces cerevisiae*
6. Isolation of amylase / protease producing organism
7. Isolation of organic acid producing organism
8. Preservation of industrially important microorganism by oil overlay method
9. Determination of blood group with Rh typing
10. Demonstration of agarose gel electrophoresis of DNA

Recommended Books:

1. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation (1996) by Aneja K.R., New Age International (P) Ltd, New Delhi.
2. An Introduction to Practical Biochemistry by Plummer D.T., 3rd Edition, Tata McGraw Hill, Delhi.
3. Biochemical Methods (1996) by Sadasivam S. and Manikam A., 2nd Edition, New Age International (P) Ltd., New Delhi.
4. An Introduction to Practical Biotechnology by Harisha S., Laxmi Publication (P) Ltd., New Delhi.
5. Laboratory Manual in Biochemistry (1999) by J. Jayaraman, New Age International (P) Ltd., New Delhi.
6. Practical Biochemistry: Principles and Techniques by Wilson K. and Walker J., 5th Edition, Cambridge Uni. Press, Cambridge.
7. Introductory Practical Biochemistry by Sawhney S.K. and Singh Randhir, Narosa Publisher, Delhi.