

**Shiksha Mandal's**  
**Bajaj College of Science, Wardha**  
**(Autonomous)**  
**B. Sc. Semester Pattern Syllabus**  
**B. Sc. Part II**  
**BIOTECHNOLOGY**  
**(With effect from academic session 2022-23)**

Total Theories required to complete syllabus of Semester III and Semester IV unit wise is given below:

**B.Sc. Part II- Semester III**

<b>Sr. No.</b>	<b>Unit</b>	<b>Total Theories Required</b>
1	Unit I	10
2	Unit II	10
3	Unit III	10
4	Unit IV	12
5	Unit V	10
6	Unit VI	12

**B.Sc. Part II- Semester IV**

<b>Sr. No.</b>	<b>Unit</b>	<b>Total Theories Required</b>
1	Unit I	12
2	Unit II	12
3	Unit III	10
4	Unit IV	12
5	Unit V	12
6	Unit VI	12

**BIOTECHNOLOGY**  
**B. Sc. Semester Pattern Syllabus**  
**(With effect from academic session 2022-23)**  
**B. Sc. Part II- Semester III**

The examination will comprise of one theory paper, one in each semester and one practical in each Semester. Each theory paper will be of 3 Hrs. Duration and carry 100 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 30 marks. The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 14 marks & one compulsory question covering all the syllabus of Semester-III (16 marks)

**B. Sc. Part II – Semester III**

**METABOLISM AND BIOPHYSICAL TECHNIQUES- I**

**Course Objectives:**

1. To aware students and to give them the basic knowledge of different biomolecules like nucleic acids, proteins etc, these are the basis for existence of the cell.
2. Students will aware with the concept of bioenergetics and various metabolic processes taking place inside the human body.
3. Students will gain knowledge about various biophysical techniques used in biological research and also their implementation in the fields of research.

**Course Outcomes:**

1. Students will be able to understand the concept of bioenergetics and carbohydrates metabolism.
2. Students will be able to develop an understanding of breakdown of different biomolecules and various physiological aspects of byproducts of metabolic pathways and their regulations.
3. Students will know how to performed colorimetric analysis.
4. Students will be able to understand concept of spectrophotometry its principle, working and applications of various spectrophotometers.
5. Students will be able to understand the principle of chromatographic techniques and perform various chromatographic techniques.

BSc -II Semester –III	METABOLISM AND BIOPHYSICAL TECHNIQUES- I	UG-BT(09)- S3-T
Unit Number	Topic	Total Theories Required
I	<p><b>Bioenergetics and carbohydrate metabolism</b></p> <p>A) Concept of free energy, Entropy, Enthalpy &amp; Redox Potential. Concept of high energy bonds as related to the structure of ATP, Phosphoenolpyruvate.</p> <p>B) Glycolysis (pathway, entry of other monosachharides and disaccharides, regulation, inhibitors), Gluconeogenesis: Bypass reactions.</p> <p>C) TCA cycle: Detailed account, regulation, amphibolic nature and anaplerosis. Electron Transport Chain: Components of the chain, sites of ATP synthesis.</p>	10
II	<p><b>Lipid Metabolism</b></p> <p>A) <math>\beta</math> -oxidation of fatty acids, role of Carnitine, oxidation of unsaturated fatty acids and odd carbon fatty acids. Regulation. Ketogenesis, Ketosis and ketoacidosis in physiology and pathology.</p> <p>B) Biosynthesis of fatty acids, fatty acid synthase complex, regulation, Microsomal and Mitochondrial system of chain elongation and synthesis of unsaturated fatty acids.</p>	10
III	<p><b>Metabolism of Nitrogenous Compounds</b></p> <p>A) Transamination (mechanism) Oxidative and Non-oxidative deamination. Urea cycle: Detail account, linkage of urea and TCA cycle, compartmentation of urea cycle, regulation, metabolic disorders of urea cycle.</p> <p>B) Transmethylation and decarboxylation, physiologically important products of decarboxylation. Biosynthesis of purines and pyrimidines: Salvage pathways.</p>	10
IV	<p>A) Spectrophotometry: Concept of electromagnetic radiation, spectrum of light, absorption of electromagnetic radiations, Concept of chromophores and auxochromes, Absorption spectrum and its uses, Beer's law - derivation and deviations, extinction coefficient.</p> <p>B) Difference between spectrophotometer and colorimeter. Instrumentation and Applications of UV and visible spectrophotometry, Double beam spectrometer; dual-wavelength spectrometer.</p>	12
V	<p>A) Principle , instrumentation and application of IR and Mass spectrometry</p> <p>B) Spectrofluorometry: Principle, instrumentation and applications. Absorption &amp; emission flame photometry: principle, instrumentation and application.</p>	10
VI	<p>A) Chromatography: Partition principle, partition coefficient, nature of partition forces, brief account of paper chromatography. Thin layer chromatography and column chromatography. Gel filtration: Concept of distribution coefficient, types of gels and glass beads, applications.</p> <p>B) Ion-exchange chromatography: Principle, types of resins, choice of buffers, applications including amino acid analyzer. Affinity chromatography: Principle, selection of ligand, brief idea of ligand attachment, specific and non-specific elution, applications. Brief note on high pressure liquid chromatography.</p>	12

Sr. No.	Practicals (UG-BT(09)-S3-P)	Minor/Major
1	Spectrophotometric analysis of DNA denaturation	Minor
2	Determination of absorption spectrum of oxy- and deoxyhemoglobin and methemoglobin.	Major
3	Protein estimation by E280/E260 method	Major
4	Paper chromatography of amino acids/sugars/lipids.	Major
5	TLC of sugars/amino acids.	Major
6	Cellular fractionation and separation of cell organelles using centrifuge.	Major
7	Isolation of mitochondria and assay of marker enzyme.	Minor
8	Estimation of Urea by diacetylenoxime method	Major
9	Estimation of Sugars by Folin Wu method.	Major
10	Validity of Beer's law for colorimetric estimation of creatinine.	Major
11	Absorption spectrum of NAD & NADH/ Determination of pKa of Amino Acid	Minor
12	Preparation of standard buffers and determination of pH of a solution.	Minor
13	Titration of a mixture of strong & weak acid.	Major
14	Performance of affinity chromatography.	Major
15	Performance of gel filtration chromatography	Major

## Recommended readings:

- Biochemistry, 4<sup>th</sup> edition, (2013), Satynarayana U, Chakrapani U., Elsevier.
- Essentials of Physical Chemistry, 24<sup>th</sup> edition, (2000), B. S. Bahl, G. D. Tuli, Arun Bahl, S. Chand Limited, India
- Lehninger's Principles of Biochemistry, 5<sup>th</sup> edition, (2008), Nelson D. L. and Cox M. M., CBS Publications,
- Principles of Biochemistry, 4<sup>th</sup> edition, (1997), Jeffery Zubey., McGraw-Hill College, USA.
- Fundamentals of Biochemistry, 3<sup>rd</sup> edition, (2008), Donald Voet & Judith Voet, John Wiley and Sons, Inc. USA
- Textbook of Biochemistry for medical student, 6<sup>th</sup> edition, (2011), Vasudewan M. D., Sreekumari S and Vaidynathan K., Jaypee Brother medical publishers.
- Laboratory manual in Biochemistry, (1981), Jayaram T., Wiley Estern Ltd. New Delhi.
- An Introduction to Practical Biochemistry. 3<sup>rd</sup> edition, (1988), Plummer D., Tata McGraw Hill, New Delhi.
- Practical Biochemistry in Clinical Medicine, (1990), Nath R L., Academic Pub.
- Biochemical Methods. 2<sup>nd</sup> edition. (1996), Sadasivam S. and Manickam A., New Age International (P) Ltd. Publisher, New Delhi.
- Biochemical Methods, 1<sup>st</sup> edition, (1995), S. Sadashivam, A. Manickam, New Age International Publishers, India
- Biophysical Chemistry, 4<sup>th</sup> edition, (2016), Upadhyay A, Upadhyay K and Nath N., Himalaya publication house.
- Biophysical chemistry 1<sup>st</sup> edition, (2008), Allen J. P., Wiley Blackwell publication.

**BIOTECHNOLOGY**  
**B. Sc. Semester Pattern Syllabus**  
**(With effect from academic session 2022-23)**  
**B. Sc. Part II- Semester IV**

The examination will comprise of one theory paper, one in each semester and one practical in each Semester. Each theory paper will be of 3 Hrs. Duration and carry 100 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 30 marks. The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 14 marks & one compulsory question covering all the syllabus of Semester-IV (16 marks)

**B. Sc. Part II – Semester IV**  
**IMMUNOLOGY AND BIOPHYSICAL TECHNIQUES- II**

**Course Objectives:**

1. The objective of this course is to familiarize students with the Immune system, different processes and cell types involved in prevention of disease.
2. Students will gain knowledge of different types of antibody, hypersensitivity, immune effector mechanism.
3. Student will gain knowledge of vaccination and various immunotechniques and immunodiagnostic.
4. Students will gain knowledge about various biophysical techniques used in biological research and also their practical implementation in the fields of research.

**Course Outcomes:**

1. Students will be able to understand immune system, properties of immune system, types of immunity, and pathways of complement systems.
2. Students will be able to understand the concept of antigen, antigenic determinants, antigenicity and factors affecting antigenicity.
3. Students will be able to understand immunoglobulin structures, types and their functions.
4. Students will know how to perform various immunological techniques.
5. Students will know how to perform electrophoretic techniques.
6. Student will be able to understand detection and recovery methods of various macromolecules by electrophoretic methods by knowing their advantages and limitations.

BSc –II Semester – IV	IMMUNOLOGY AND BIOPHYSICAL TECHNIQUES- II	UG-BT(09)- S4-T
Unit Number	Topic	Total Theories Required
I	A) Immune system, Organs and cells of immune system, Immunity, innate immune mechanism, Acquired immune mechanism, Antigen, Antigenicity (factors affecting antigenicity), Humoral immunity and main pathways of complement system. B) Vaccination: Discovery, principles and significance.	12
II	A) General structure of Antibody and different classes. Cell mediated immunity: TC mediated immunity, NK cell mediated immunity, ADCC, cytokines and brief idea of MHC molecules and different classes, Concept of autoimmunity. B) Hypersensitivity: General features and various types of hypersensitivity.	12
III	A) Immunological Techniques: Antigen-antibody reactions: Precipitation, agglutination, complement fixation, immunodiffusion, ELISA. B) Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnosis.	10
IV	A) Electrophoresis: Definition, Migration of ions in electric field and Factors affecting electrophoretic mobility. B) Paper electrophoresis: - Electrophoretic run, Detection techniques. C) High Voltage Electrophoresis. D) Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery and Techniques used for estimation of macromolecules.	12
V	A) SDS-PAGE Electrophoresis: principle, procedure and application. B) Pulsed-field gel electrophoresis: principle, procedure and application. Isoelectric focussing: principle, procedures and applications. . C) Centrifugation: Basic principles, concept of RCF, types of centrifuges (clinical, high speed and ultracentrifuges). Preparative centrifugation: Differential and density gradient centrifugation, applications Analytical centrifugation: Sedimentation coefficient, determination of molecular weight by sedimentation velocity and sedimentation equilibrium methods.	12
VI	<b>Isotopic tracer technique: -</b> A) Radioactive & stable isotopes, rate of radioactive decay. Units of radioactivity. B) Measurement of radioactivity: - Ionization chambers, proportional counters, Geiger- Muller counter, Solid and liquid scintillation counters (basic principle, instrumentation and technique). C) Principles of tracer technique, advantages and limitations, applications of isotopes in biological science.	12

Sr. No.	Practicals (UG-BT(09)-S4-P)	Minor/Major
1	Antigen –antibody reaction – determination of Blood group	Minor
2	Pregnancy test.	Minor
3	Widal test.	Minor
4	Ouchterloney immunodiffusion.	Major
5	Radial immunodiffusion.	Major
6	ELISA (Enzyme Linked Immunosorbent Assay)	Major
7	Isolation of casein by isoelectric precipitation.	Major
8	Immuno-electrophoresis	Major
9	VDRL (Venereal Disease Research Laboratory Test)	Major
10	One step test for Qualitative detection of HBs.	Minor
11	Separation of different components from clinical specimen (Blood or Urine) using centrifugation.	Major
12	TRUST [Toluidine Red Unheated Serum Test]/Rapid test for Malaria detection	Major
13	Paper electrophoresis of proteins.	Major
14	Gel electrophoresis of Nucleic acids (DNA/RNA) .	Major
15	SDS-PAGE of an Oligomeric protein.	Major

### Recommended readings:

1. Essential Immunology, 10<sup>th</sup> edition, (2001), Roitt I.M., Delves P.J. Oxford Blackwell Science
2. Essential Immunology, 1<sup>st</sup> edition, (2012), Gupta S.K., Aray Publication New Delhi.
3. Kuby Immunology, 7<sup>th</sup> edition, (2013), Punt, Stranford, Jones, Owen. W. H. Freeman & company.
4. Textbook of Basic and Clinical Immunology, 1<sup>st</sup> edition, (2013), Gangal S., Sontakke S., University Press, India
5. Textbook of Immunology, 2<sup>nd</sup> edition, (2012), Basir F., Prentice Hall India Learning private limited.
6. Fundamental of Medical Immunology, 1<sup>st</sup> edition, (2007), Jaypal V., Jaypee Brother medical publisher (P) LTD, India
7. Textbook of Microbiology, (2006), Ananthanarayan R. and Paniker's CK., University Press Publication.
8. Laboratory Manual in Biochemistry, (1981), Jayaram T., Wiley Estern Ltd. New Delhi.
9. An Introduction to Practical Biochemistry. 3<sup>rd</sup> edition, (1988), Plummer D., Tata McGraw Hill, New Delhi.
10. Practical Biochemistry in Clinical Medicine, (1990), Nath R. L., Academic Pub.
11. Biochemical Methods. 2<sup>nd</sup> edition, (1996), Sadasivam S. and Manickam A., New Age International (P) Ltd. Publisher, New Delhi.
12. Biochemical Methods, 1<sup>st</sup> edition, (1995), S. Sadashivam, A. Manickam, New Age International Publishers, India
13. Biophysical Chemistry, 4<sup>th</sup> edition, (2016), Upadhyay A., Upadhyay K. and Nath N., Himalaya publication house.
14. Biophysical chemistry 1<sup>st</sup> edition, (2008), Allen J. P., Wiley Blackwell publication.