Gondwana University, Gadchiroli
Faculty of Science

Syllabus

B. Sc. II

BIOCHEMISTRY

(SEMESTER III & IV)

(with effect from academic session 2013-14)
1) There shall be two semesters in B.Sc. Part II Biochemistry.
2) Each semester comprise of two theory papers, internal assessment and practical.
3) Each theory paper divided into four units.
4) The syllabus is based on six theory periods and six practical periods per batch per week.
5) Students are expected to perform all the practicals mentioned in the syllabus. However a minimum of seven experiments in each semester is mandatory.
6) Each theory paper examination shall be of three hours duration, comprise 5 questions and carry 50 marks. The practical examination shall be of 6 hours duration and carry 30 marks.
7) The B.Sc. students of Biochemistry shall pay at least one visit to any Biochemical/Research Institute as a study tour during three year (six semester) degree course.

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<th>Sr No</th>
<th>Semester</th>
<th>Paper No.</th>
<th>Title of Paper</th>
<th>Total periods/ Week</th>
<th>Max.Marks</th>
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<td>III</td>
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<td>Macromolecules</td>
<td>03</td>
<td>50</td>
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<td>II</td>
<td>Biophysical and Biochemical Techniques I</td>
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<td>Practical</td>
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<td>IV</td>
<td>I</td>
<td>Enzymology</td>
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Marks Distribution:
1. Theory Exam : 50 Marks (for each paper)
2. Internal Assessment : 10 Marks (for each paper)
3. Practical : 30 Marks

Distribution of Marks in practical Examination:
1. Experimental work - 20 marks
2. Practical record - 05 marks
3. Viva - 05 marks

Study tour:
The B.Sc. students of Biochemistry shall pay at least one visit to any Biochemical/Research Institute as a study tour during three year (six semester) degree course.
UNIT I:

a) History & Terminology
b) Classification & nomenclature of enzymes, Specificity of enzyme action (Lock & key model & Induced fit model).
c) Enzyme catalysis: Proximity & Orientation effect, covalent catalysis, acid-base catalysis, metal ion catalysis.
d) Regulatory enzymes: - Allosteric (ATCase) & covalently modulated (Glycogen phosphorylase) enzymes.

UNIT II:

a) Mechanism of action of Chymotrypsin and Ribonuclease.
b) Role of vitamins as coenzyme precursors (Riboflavin, Niacin, Pyridoxine, Biotin and Thiamine)
c) Effect of enzyme concentration, upward & downward curvatures with examples.
d) Effect of temperature on enzyme activity & temperature quotient.

UNIT III:

a) Enzyme kinetics: Importance of measuring initial velocities, Derivation of Michaelis-Menten equation, Single & double reciprocal plots.
b) Graphical representation of various inhibitors (Competitive, Noncompetitive & Uncompetitive) on Lineweaver-Burke plots.
c) Importance of $K_{cat}/K_m$ Bisubstrate reactions – brief introduction to sequential and ping-pong mechanisms with examples.
d) Effect of pH, General pH profile diagram with exception

UNIT IV:

a) Concept of enzyme assay & its importance.
b) Enzyme activity units (Katal & Specific activity)
c) Enzyme isolation and purification:- Enzyme solubilization, Brief idea of various fractionation procedures, Criteria for enzyme purity and homogeneity.
d) Medicinal applications of Enzyme
e) Enzyme immobilization - methods and its industrial applications.

UNIT I: Electrophoresis:

a) Migration of ions in electric field, Factors affecting electrophoretic mobility.
c) Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules, Applications.

UNIT II: Electrophoresis:

a) Disc-Gel electrophoresis: - Procedure & Applications.
b) SDS-PAGE Electrophoresis: - Isoelectric focussing, Principle, Establishing pH gradients, Stabilization against convection, Procedures & applications.
c) Immunological techniques: Immunodiffusion, Immunelectrophoresis, Radioimmunoassay, ELISA and immunofluorescence.

UNIT III: Isotopic tracer technique:
a) Radioactive & stable isotopes, Pattern and rate of radioactive decay. Units of radioactivity.
c) Measurement of stable isotopes by Mass Spectrometry
d) Isotopes commonly used in biochemical studies – $^{32}$P, $^{35}$S, $^{14}$C, $^{3}$H. Applications of isotopes in biochemistry, Principles of tracer techniques, Its advantages and limitations, Distribution studies, Isotope dilution technique, Metabolic studies, Clinical application.

UNIT IV: CENTRIFUGATION:
a) Basic principles, Mathematics & theory (RCF, Sedimentation coefficient, Svedberg constant)
b) Types of centrifuge: - Desk top, High speed & Ultracentrifuges.
c) Preparative centrifugation: - Differential & density gradient centrifugation, Applications (Isolation of cell components).
d) Analytical centrifugation: - Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods.

B. Sc. Part II Semester IV
Practicals
1) Estimation of ascorbic acid by 2,6-dichlorophenol indophenol method
2) Isolation of casein by isoelectric precipitation method.
3) Estimation of proteins by Folin-Lowry’s method.
4) Fractionation of proteins by ammonium sulphate and determination of its purity by PAGE electrophoresis.
5) To show using PAGE that commercially available BSA is not a homogeneous preparation.
6) SDS-PAGE of BSA & comparison of results with previous (PAGE) experiment.
7) Immobilization of enzymes / cells by entrapment in alginate gel.
8) Isolation of cell organelles by differential centrifugation.
9) Assay of salivary amylase.
10) Isolation of Urease and demonstration of its activity.
12) Gel electrophoresis of serum proteins.
13) Effect of pH on activity of enzyme.
14) Effect of temperature on activity of enzyme.
15) Demonstration of dialysis.
16) Radial immunodiffusion.
17) Widal test.
18) Demonstration of Salting-Out of proteins by ammonium sulphate precipitation.

(Mandatory to perform atleast 7 practical)

Semester IV
Books for Reference
1) Biochemistry – Lehninger – CBS publishers.
3) The nature of enzymology – Foster – Croom Helm, London.
11) Outlines of Biochemistry – Conn & Stumpf.
15) Biologist’s Physical Chemistry – T. G. Morris.
16) Enzyme Kinetics – Paul Engel.
17) Enzyme Technology – Chaplin, Buche – Cambridge Univ. Press.
20) Physical biochemistry – vanHolde – Prentice Hall Inc.