UNIVERSITY OF KALYANI

REVISED SYLLABUS

FOR THREE YEARS B.Sc. DEGREE COURSE

(GENERAL)

IN

MOLECULAR BIOLOGY

According to the New Examination Pattern
Part – I, Part- II & Part- III

WITH EFFECT FROM THE SESSION
2009 – 2010
Revised Structure and Distribution of Marks for Practical Based Subjects at UG Level w.e.f. Academic Session 2005-2006

### BACHELOR OF SCIENCE (GENERAL)

<table>
<thead>
<tr>
<th>Part</th>
<th>Compulsory English</th>
<th>Modern Indian Language</th>
<th>Environmental Studies</th>
<th>Elective Subjects</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>50 Marks</td>
<td>50 Marks</td>
<td>100 Marks*</td>
<td>3x1x100 =300 Marks</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td>2x2x100 =600 Marks</td>
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<tr>
<td>III</td>
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<td>Th: 3x1x100 =300 Marks</td>
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<td></td>
<td></td>
<td></td>
<td>Pr: 3x1x100 =300 Marks</td>
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**Elective Subjects:** Three full papers: 2x3x100 each = 600 Marks

**Environmental Studies:** One full paper* : 100 Marks*

**AGGREGATE MARKS**: 1400

### BACHELOR OF SCIENCE (HONOURS)

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<th>Modern Indian Language</th>
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<th>Elective Subjects</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>50 Marks</td>
<td>50 Marks</td>
<td>100 Marks*</td>
<td>2x1x100 =200 Marks</td>
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<tr>
<td>II</td>
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<td>2x2x100 =400 Marks</td>
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<tr>
<td>III</td>
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<td></td>
<td></td>
<td>Th: 2x1x100 =200 Marks</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pr: 2x1x100 =200 Marks</td>
</tr>
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**Elective subjects:** Two full papers: 2x3x100 each = 600 Marks

**Environmental Studies:** One full paper* : 100 Marks*

**One Honours Subject** = 800 Marks

**Theory:** Seven Papers = 540 Marks

**Practical:** Four Papers = 260 Marks

**AGGREGATE MARKS**: 1600

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*With effect from the session 2009-2010.*
University of Kalyani

Revised Syllabus of Molecular Biology (General Course)

(w.e.f. the session 2009-2010)

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PART - 1

Paper – I  

Full Marks : 100

Group A : Biochemistry  

Full Marks : 50

1. Biochemical characteristics of living matter: 

2. Cell Biology: 
   Salient feature of prokaryotic and eukaryctic cells, mentioning structure and function of: Cell wall, Plasma membrane, nucleus, mitochondria, endoplasmic reticulum, Golgi complex, lysosomes and ribosomes.

3. Carbohydrates: 
   Structure and function of mono, di and polysaccharides, Reducing & non-reducing sugar, deoxy sugars, reactions of monosaccharides.

4. Lipids: Types of lipids; 
   Triglycerides, fatty acids, Phospholipids, Glycolipids; Structure, Function and Localization; active transport.

5. Aminoacids and Proteins: 
   Structure and reactions of aminoacids, Structure of Proteins (concepts of primary, secondary, tertiary and quaternary), General reactions of Proteins, N-terminal and C-terminal aminoacid determination.

6. Enzymes: 
   Role as biocatalyst, nature, nomenclature; An outline of classification with example of each type, enzyme kinetics, Coenzymes, Cofactors, enzyme inhibitors, isozymes, Ribozyme.

7. Nucleic acids: 
   Purine and Pyrimidine bases, nucleosides, nucleotides, basic differences in structure and function of RNA and DNA.
Group B : Biophysics

Full Marks : 50

1. **Biophysical Principles** :

   Thermo dynamics (Basic Principle)
   Diffusion in liquids : Osmosis, Viscosity, Centrifugation, Sedimentation Velocity, Sedimentation equilibrium, Density gradient Centrifugation.
   Light absorption : Beer- Lambert law. Gel electrophoresis and Gel chromatography.
   X-ray Production and Properties, basic principles of diffraction, medical applications.

2. **Optical and electron microscopy** : 


3. **Biostatistics** :

   Frequency distribution, Mean, Median, Mode, Standard-deviation, Binomial, Poisson and Gaussian distribution t-test and Chi-square test with biological examples.

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**PART – II**

**Paper – II**

Full Marks : 100

Group A : Biochemistry

Full Marks : 50

1. **Bioenergetics** :

   Concept of free energy, Biological oxidation, Electron-transport chain, Energy rich compounds, Oxidative Phosphorylation including chemiosmotic hypothesis.

2. **Metabolism of Carbohydrate** :

   Glycolysis, TCA cycle, Pentose Phosphate Pathway, Glycogenesis and Glycogenolysis.

3. **Metabolism of fat** :

   Catabolism of fat, Oxidation of fatty acids.
4. **Metabolism of amino acid**:  
Biosynthesis of amino acid with reference basic groups citing example of each. Glucogenic and Ketogenic amino acids, transamination, damination, Oxidation of \( \alpha \)-aminoacids, Urea cycle.

5. **Nutrition**:  
Deficiency symptoms, Food sources, Required dietary allowance, chemical nature, cofactor function of water soluble vitamins. Fat soluble vitamins – chemical nature function.

6. **Hormones: Steroid & peptide hormones.**  
Definition, classification and molecular basis of hormone action.

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**Group B: Biophysics**

1. **Fundamentals of Genetics**:  
Concept of heredity, Mendilhon concept, Heredity factor & chromosomes, gene concept chemical nature of gene.

2. **Physical foundation of Molecular Biology**:  
Types of DNA replication, transcription and translation of prokaryotic system. Damage of genetic materials and their repair. Genetic mutation & Molecular basis of mutation, Molecular diseases.

3. **Radiation Biology**:  
Different types of radiation – ionizing and non-ionizing radiations. Radioactivity – type of radiation from radioactive substances (\( \alpha \),\( \beta \),\( \gamma \)-radiation). Radioactive decay equation, Physical and biological half lives, Radiation units, Radiation counting systems – G.M. Counter and Scintillation Counter (Working Principle) only.

Interaction of radiation with matter. Biological effects of different types of radiation. Application of radioactive material in Biology and medicine, Radiation Protection.
**Paper – III (Practical)**

**Group A : Biochemistry**

1. Preparation of buffers (acetate & phosphate).
2. Qualitative tests for Glucose, Fructose, Ribose, Starch and Sucrose.
3. Test for cholesterol.
4. Chemical test for amino acids and proteins, Estimation of amino acid by formal titration.
5. Estimation of ascorbic acid in lemon juice by titration with 2,6 Dichlorophenol Indophenol.

**Group B : Biophysics**

1. To determine the absorption spectrum of hemoglobin/chlorophyll/ cytochrome C solution by a colorimeter.
2. To determine the refractive index of different solutions using a travelling microscope.
3. To measure the viscosity/fluidity of a solution by Oswald Viscometer.
4. To determine the relative sizes of nucleus and cytoplasm of squamous cells using a biological microscope.
5. To measure the concentration of R.B.C. cells in a suspension using haemocytometer and to test its distribution.

**PART – III**

**Paper – IV**

**Group A (Theoretical)**

(I) Biochemistry

1. **Recombinant DNA technology :**

   Preliminary aspects of recombinant DNA technology — basic concepts of genetic engineering.

2. **Clinical Biochemistry :**

   Molecular mechanism of diseases (sickle cell anemia, Malaria, Thalassemia, Cholera). Clinically important enzymes. Drug metabolism and Drug toxicity.
3. **Microbial Biochemistry**:

A brief idea about different types of microorganism – both pathogenic and non-pathogenic. Mode of action of the antibiotics – penicillin, streptomycin and chloramphenicol. Antibiotic resistance in microbes.

(II) Biophysics

1. **Bioelectricity**:

Physical basis of bioelectric potential (Gibbs Donnan effect, membrane transport – basic ideas); Biophysics of the neural spike, electrocardiogram, electroencephalogram.

2. **Physics of Nuclear Medicine**:

Radioisotope as tracer, Organ scan as examples of tracing, Isotope dilution analysis, Radioimmuno assay, Thyroid function test by radioiodine, Basic Principle of autoradiography, Gamma camera, Magnetic resource imaging, LASER in medicine (brief qualitative treatment).

3. **Physics of Vision**:

Optical elements of the eye, defects of vision and their correction (Qualitative) mechanism of vision (red and cone vision), visual sensitivity (Qualitative); Electoretinogram(basic principle).

4. **Physics of Hearing**:

Intensity level, noise and its biological effects, hearing elements of the ear, mechanism of hearing. Echolocation by bats (elementary ideas), Ultrasonic Production (by Piezoelectric effect) and medical application (basic principle)

Group B (Practical)

(I) Biochemistry

1. Estimation of Glucose in blood.
2. Estimation of Cholesterol in blood.
3. Detection of blood groups and R h factor.
4. Simple Staining and Gram staining of Bacteria.
5. Estimation of Urea SGOT/SGPT in blood.
7. Growth curve of a bacterium.
(II) Biophysics

1. Blood Pressure Measurement (Demonstration & interpretation)
2. E.C.G. (Demonstration & interpretation)
3. Interpretation of X-ray Photographs
4. Interpretation of ultrasound
5. Interpretation of EEG
6. Estimation of DNA by Diphenylamine method