UNIVERSITY OF KALYANI

FACULTY OF SCIENCE

DEPARTMENT OF BIOCHEMISTRY AND BIOPHYSICS

PhDCoursework Syllabus [As perAmended PhDRegulation2021]

Paper-7 (01-RM/A)	**100**
Paper-7 (02-RM/B)	**100**
Paper-7 (03-ALC/A)	**100**
Paper-7 (04-ALC/B)	**100**

PhDCourseworkSyllabus[As per AmendedPhDRegulation2021]

For the
Department of
Biochemistry and Biophysics

Paper-7(01-RM/A) **[FM: 100, 4 credits]**
The Course-work of the Paper 7(01-RM/A) shall be conducted at Faculty level (controlled centrally).

Research Methodology (A) Quantitative Methods, Computer Applications, Research Ethics, Training, Field Work, etc.
Marks Allotted: 60+20+20 (Term End Examination+ Internal Assessment + Viva-voce Examination) =100
Credits Allotted: 04

Paper-7(02-RM/B) **[FM: 100, 4 credits]**

Research Methodology (B) Review of Published research, Documentation / Submission of Reports on Review work and Presentation. *Marks Allotted: 60+20+20 (Report +Presentation + viva-voce) =100*
Credits Allotted: 04

Paper-7 (03-ALC/A) **[FM: 100, 4 credits]**

Advanced level course on subject (A) Subject Specific Components
Marks Allotted: 60+20+20 (Term End Examination + Internal Assessment + Viva-voce Examination) =100
Credits Allotted: 04

Any two topics between I to III to be chosen by the candidate.

I. Spectroscopy & Crystallography **[FM = 50, 2 credits]**

1. **Crystallography:** Overview of crystallography as a tool of structure determination. XRD, single crystal diffraction. Steps of structure determination in brief, Crystallisation techniques and principles. Data collection and processing. Model building and Refinement. Structure validation

2. **NMR spectroscopy:** Basic principle; 2D NMR; COSY; TOCSY; NOESY; Different applications of NMR spectroscopy.

3. **Spectroscopy:** UV-Visible Spectroscopy, IR and Raman spectroscopy, Photon Correlation Spectroscopy, DLS, FTIR.
4. **Microscopy:** Light microscopy, Phase Contrast Microscopy, Dark Field Microscopy, Fluorescence microscopy, Confocal Microscopy, Atomic Force Microscopy, Scanning Electron Microscopy, Energy Dispersive Spectroscopy (EDS-EDAX), Transmission Electron Microscopy, Scanning Tunnelling Electron Microscopy.

II. Cell Culture and Cell Biology Techniques [FM = 50, 2 credits]

1. **Cell Culture Techniques:** Introduction to mammalian cell culture, cell culture laboratory, cell culture equipment, aseptic technique, biological contamination, culture environment, sub-culturing adherent cells, sub-culturing suspended cells, freezing cells, thawing frozen cells, transformation and development of continuous cell lines, sterilization, sterile handling, media, serum, culture vessels, laboratory safety and bioethics.

2. **Parasite cell culture techniques**

3. **Flow Cytometry:** History, Components of Flow Cytometry, flow data plots and gating, applications.
4. **Immuno-techniques:** Antibody generation, Antibody isolation and purification, ELISPOT, Immunoblotting, Immuno-histochemistry, Immunoprecipitation, Immune cell isolation, Single diffusion in one dimension (Oudin Procedure), Double diffusion in one dimension (Oakley-Fulthrope Procedure), Single diffusion in two dimensions (Radial immunodiffusion), Double diffusion in 2-Dimension (Ouchterlony Procedure), Counter immuno-electrophoresis, Rocket electrophoresis, Radioimmunoassay (RIA), ELISA and its molecular aspect.

III. Computational methods: [FM = 50, 2 credits]

1. Introduction of Biocomputing: General overview of the subject
   Basics of biological databases- Creation and organizations of databases
   Features of databases;
   Analysis of sequence databases- NCBI, UniProt
   Analysis of structural databases: PDB, NDB, CSD
   Utilities of databases

2. Introduction to R programming and its Applications in wet-lab data handling

Paper-7 (04-ALC/B) **[FM: 100, 4 credits]**

Advanced level course on subject (B)* Transdisciplinary Components

Marks *Allotted: 60+20+20 (Term End Examination + Internal Assessment + Viva-voce Examination)=100*

Credits Allotted: 04

*(Two transdisciplinary courses shall be chosen from a group of transdisciplinary recognized subjects)

I. Hadron Biology: [FM: 50, 2 credits]

1. EM radiation and its interaction with matter. Dose, LET and RBE value. Effect of EM on biomolecules, cell and cellular response against it. Interaction of biomolecules with high energy particle. Basic difference between high LET and low LET radiation

2. History of hadronbiology and hadrontherapy, Particle therapy using carbon ion

3. Basic interaction of high LET ion beam with cellular materials, Cellular response against high LET ion beam

4. Hadrontherapy- its promises and challenges.

II. Nanoscience & Nanotechnology: [FM: 50, 2 credits]

1. An overview of Nanoscience & Nanotechnology
2. Nanomaterials (0-, 1-, 2- & 3-dimensional)
3. Properties and their genesis (optical, electrical, magnetic etc.)
4. Synthesis methods (top-down & bottom-up approaches, Physical & Chemical methods)
5. Application (solar energy conversion & other non-conventional energy production)
6. Nano-biotechnology (development of biosensors, nano-drugs & nano-medicines)
7. Nano-toxicology & ethical issues

III. Drug Design and Molecular Interactions: [FM: 50, 2 credits]

1. Basic principle of molecular modeling and docking

2. Idea of lead compounds and pharamacophores

3. Idea of selection of drug candidates

4. Nanoparticles as drug candidates

5. Case studies of computational drug designing techniques

IV. PCR Technique and its Transdisciplinary Applications: [FM: 50, 2 credits]

1. Variants of PCR techniques: Real-time (quantitative & semi-quantitative), RT-PCR etc.

2. PCR in detecting genetic diseases: Insertion, deletion or alteration of genes which are associated with several genetic diseases.

3. Detection of polymorphism by PCR combined with SSCP gel.

4. Application in Forensic Science and Judiciary; Identification of animal and plant varieties; Microbials for food quality testing etc.