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PHILOSOPHY OF BIOCHEMISTRY DEPARTMENT

The major thrust of the Department's Postgraduate training is research, which must have considerable biochemical content and should be conducted in any of the following or other areas of biochemistry under the supervision of approved supervisory committee as staff and equipment are available.

- Molecular biology of Tropical diseases
- Biotechnology & Medical Biochemistry
- Medicinal Plants (therapeutic & toxicological evaluation)
- Nutritional biochemistry & Environmental Toxicology
- Enzymology
- Microbial biochemistry
- Analytical biochemistry

VISION OF BIOCHEMISTRY DEPARTMENT:

To operate an undergraduate and postgraduate training to make students understand modern biochemistry and prepare them for research and advance teaching in Biochemistry.

To graduate students from the programmes to take up employment with Analytical and Biotechnology laboratories, biochemical industries, international agricultural research institutes and medical organizations.

MISSION OF BIOCHEMISTRY DEPARTMENT:

To train suitable high-level manpower with adequate theoretical and practical biochemical knowledge preparatory for a host of challenges in Research, Industries, Community, National and International services especially with particular reference to Universities, Research Institutes, Industries, Biotechnological Laboratories in Medical, Food and Agricultural ventures.

Postgraduate Diploma in Forensic Biotechnology

Postgraduate Diploma in Forensic Biotechnology is a one year (12 months) professional diploma in the area of forensic medicine and molecular diagnostics. The target group are health officers, scientists without practical knowledge of molecular genetics, clinicians, and particularly law enforcement officers and lawyers interested in modern forensic technology including applications in paternity and individual identification issues. The greater proportion of participants will be officers in government and non-governmental establishments. The course will involve taught courses and hands-on practical training.

The programme is hosted in the Department of Biochemistry in conjunction with the Centre for Biotechnology Research and Training, Ahmadu Bello University, Zaria.

Main Objective of The PGD Forensic Biotechnology

The programme has as its main objective the production of manpower with skills in forensic biotechnology to solve relevant societal problems.

Specific Objectives

- To train manpower that will be engaged in crime prevention and control
- To train manpower in the prevention and control of invasive species
- To train manpower that will assist in individual identification during emergencies
- To train manpower that will engage in solving paternity and related issues
- To develop, maintain and collate database of individual profiles and invasive organisms for Nigeria and the West African sub-region
- To develop human and infrastructural capacity in biotechnology for the country and the West African sub-region
- To render consultancy services to individuals, agencies, and bodies.

CAREER OPPORTUNITIES

The programme is designed to produce manpower in areas where forensic biotechnology applications are needed. Graduates of the programme will find job placements in:

a. Law Enforcement Agencies such as Police, Custom, Immigration, Armed Forces, Prisons Services, Civil defences, etc

b. Government Ministries, Departments and Agencies such as National Emergency and Management Agency (NEMA), Nigerian Agricultural and Quarantine Services, National Agency for Foods Drug Administration and Control (NAFDAC), National Drug Law Enforcement Agency (NDLEA) and similar organizations in the Sub regions.

c. Research and Tertiary Educational Institutions
d. Non-Governmental Agencies
e. Biomedical research and pharmaceutical sector
f. Medical and veterinary diagnostic laboratories
g. Environmental pollution and waste management, palaeontology and biodiversity analysis

ADMISSION REQUIREMENT

To be considered for admission into the course, the applicant must satisfy the following requirements:

i. A first degree in Biochemistry and other Natural Sciences, Agriculture, Veterinary, Medical and Pharmaceutical Sciences, and Chemical Engineering with at least a third class honours of Ahmadu Bello University or HND with upper credit or
ii. An equivalent degree from another University recognized by Ahmadu Bello University.
iii. At least two favorable letters of recommendation, one of which **must be** from the applicant's previous academic advisor.

- Forty percent (40%) of the admission quota will be reserved for female applicants.
- Similarly, thirty percent (30%) of the admission quota will be reserved for non Nigerians.

Duration

The postgraduate diploma in Forensic Biotechnology shall be for a duration of 12 calendar months, inclusive of teaching, research project and examination.

Graduation Requirements

The programme shall be run using a combination of approaches namely, taught courses (lectures), laboratory exercises, seminars, assignments and independent research project activities. The research component may run concurrently with the second semester of the programme.

For successful completion of the coursework aspect of the PGD Forensic programme, a student is required to:

- Attain at least 75% attendance of lectures and laboratory practical works
- Register for and pass all the taught core courses (20 Credit Units) and a minimum of 2 Credit units of electives.
- Obtain a minimum of "C" grade in all the core courses
- Present a written non-thesis, supervised project
- Present at least one seminar per semester

Examination

For the purpose of evaluating the knowledge and skills acquired by the students, the courses are organized in course units and are divided into core courses and electives.

Evaluation of understanding and acquisition of skills imparted will be done using the following tools:

- Descriptive examination (essays and multi-choice questions)
- Case studies
- Seminars
- Practical reports
- Assignments, and
- Project works

Continuous assessment shall constitute a minimum of forty percent (40%) of the overall score of the examination by the students. The continuous assessment component can be in the form of assignment, tests, and laboratory work reports.

Grading of Performance

At the completion of the programme, students' performances shall be classified into four categories:

- Distinction: 70% and above
- Credit: 60-69%
- Merit: 50-59%
- Fail: less than 50%

Course structure

Course Code	Course Title	Credit Units
FIRST SEMESTER		
CORE		
SCI 801	Management and Entrepreneurship	2
FBTE 701	Basic Biochemistry	2
FBTE 703	Introduction to Biotechnology	2
FBTE 705	DNA and Forensic Technology	2
FBTE 707	Genomics / Proteomics	2
FBTE 709	Principles of Forensic Sciences	2
FBTE 711	Legal Issues in Forensics	1
FBTE 713	Forensic Biotechnology Applications I	2
FBTE 715	Bioethics and Biosafety	2

ELECTIVES		0
FBTE717	Forensic Toxicology	1
FBTE719	Forensic Pathology	1
SECOND SEMESTER		
CORE		
SCI 802	ICT and Research Methodology	2
FBTE702	Bioinformatics	2
FBTE704	Forensic Biotechnology Applications II	2
FBTE706	Genotyping and Hereditary	2
FBTE708	Laboratory Operating Standards and Quality Assurance	1
FBTE710	Introduction to Research Techniques and Data Acquisition	1
FBTE712	Seminars	2
FBTE700	Research Project	6
ELECTIVES		0
FBTE714	Forensic Archeology	1
FBTE716	Forensic Entomology	1
THIRD AND FOURTH SEMESTERS		
Conclusion of research project, Seminar and write – up of Projects		

COURSE CONTENT

SCI801: Management and Entrepreneurship

SCI802: **ICT and Research Methodology(2cu)**

FBTE701: Basic Biochemistry: Water molecules, pH, Buffer, Introductory macro-molecules (amino acids, carbohydrates, proteins, lipids, nucleic acids).

FBTE702. Bioinformatics: Genetic code, Bioinformatics tools, Genomics, Proteomics Database and applications, Gene and homology search, Genomic sequence analysis, Sequence alignment, BLAST search, Phylogenetic analysis and evolution.

FBTE703: Introduction to Biotechnology: Definitions of Biotechnology, History of Biotechnology, Biotechnology tools, Applications of Biotechnology, Commercialization of Biotechnology.

FBTE704: Forensic Biotechnology Applications 2: Principles and techniques of Restriction fragment length polymorphism (RFLP), Random amplified polymorphic DNA (RAPD), Amplified fragment length polymorphism (AFLP), Microsatellites, Single nucleotide polymorphism (SNPs), Gene Sequencing. Module also encompasses laboratory exercises.

FBTE705: Forensic DNA Technology: Introduction to genetic engineering, Basic techniques in genetic engineering, Gene cloning strategies, DNA finger printing and profiling, PCR (DNA amplification), Applications of DNA finger printing.

FBTE706: Genotyping and Hereditary. Hereditary: Genes, genetics, genotype, phenotype, karyotyping, homozygosity/heterozygosity, DNA replication, fertilization, crossing/hybrids,

segregation and probability. **Genotyping:** genomic sequence variation/ DNA polymorphisms (deletions, duplications, insertions, single base differences), DNA fingerprinting, restriction fragment length polymorphisms (RFLP), DNA hybridization, DNA probes, satellite DNA, DNA markers.

FBTE707: Genomics/Proteomics: Proteomics definition and goals, Protein synthesis, Principles of Proteomics/Genomics, Protein/Gene expression systems, Principles of DNA microarray, Overview of central dogma.

FBTE708: Laboratory Operating Standards and Quality Assurance: Good laboratory practice regulations, Standard operating procedures, Facilities design, equipment and chemicals, Quality inspections and audits, System audits, Quality audit checklists.

FBTE709: Principles of Forensic Sciences: Introduction to Forensic Sciences (definitions, divisions of forensics), Biological specimens (identification, uses, applications)

FBTE710: Introduction to Research Methodology and Data Acquisition: Definitions, selection of research themes, sources of data, data collection techniques, sampling techniques, treatment of data and presentation and report writing.

FBTE711: Legal Issues. Detection or investigation of crime and the administration of justice, crime scene investigation, constitutionality of compulsory DNA testing at the time of arrest and the use of DNA profiling and population databases; the Nigerian legal system as regards admissibility of evidence.

FBTE712: Seminars

FBTE713: Forensic Biotechnology Applications 1: Electrophoresis (Gel or Dot; Northern, Southern and Western), PCR, Extraction of DNA from blood and biological materials, DNA Testing Tools, Kits and Equipment.

BTEC714: Introduction to Forensic Archeology: Excavation and field recordings, skeletal analysis, introduction to biological archeology, forensic examination and analysis of physical evidence, human remains and environmental evidence.

FBTE715: Bioethics and Biosafety.

Bioethics: Moral values and human embryo and implications to stem cell research, politics and policy of therapeutic cloning, genetic interventions and ethics, ethics and regulatory issues in pharmacogenomics, animal experimentation, bioterrorism, organ transplantation and bio-banking; sterile insects release programmes and GMOs.

Biosafety: risk assessment, biosafety levels in laboratories, codes of practices, waste disposal, disinfection and sterilization techniques, certification of lab facilities, lab safety requirements and safety equipment, contingency and emergency plans, chemical fire and electrical safety, safety checklists and capacity training on safety practices.

FBTE716: Introduction to Forensic Entomology:

Origin and history of forensic entomology, insect orders used in forensic entomology, Life Cycle and ecology of Calliphoridae, Sarcopharidae and Coleoptera. Evidence insects and arthropods provide in forensic investigation. Breakthrough and challenges in the Science of Forensic Entomology. Functional genomics and molecular genetics in other insects of medical and

veterinary importance. Advances in insect molecular biology, applications of entomological research.

FBTE717: Introduction to Forensic Toxicology: Identification of foreign chemicals and toxins, analysis of toxins/samples, detection and classification of toxins.

FBTE719: Introduction to Forensic Pathology: Basic knowledge and skills in pathology, Pathological basis of diseases, Pathological features (microscopic and macroscopic), General cytology, Histopathology (basic knowledge, surgical reporting), Basic autopsy and autopsy techniques, physical and sexual assault, medico-legal death investigation and preservation of pathological specimens.

FBTE700: Research Project

MASTER OF SCIENCE (MSc) IN BIOTECHNOLOGY

Main Objective

The M.Sc. and PhD degree programmes have as their main objective the production of manpower with skills in various aspects of biotechnology to solve relevant societal problems.

ADMISSION REQUIREMENT

To be considered for admission into the M.Sc. progammes, the applicant must satisfy the following requirements.

i. Applicants must have five (5) credit passes including English language, Mathematics, Biology, Chemistry and Physics.
ii. A first degree in Biochemistry, any Natural Sciences, Agriculture or Human and Veterinary Medicine or Pharmaceutical Sciences with at least a second class honours of Ahmadu Bello University or
iii. An equivalent degree from another University recognized by Ahmadu Bello University.
iv. At least two favorable letters of recommendation, one of which must be from the applicant's previous academic adviser.

Duration of Programme

The progarmme shall run for a minimum of FOUR (4) semesters and a maximum of SIX (6) semesters.

Graduation Requirements

a. Course work: For the purpose of the M.Sc. written examination, the courses are organized in course units and are divided into core courses and electives. For the successful completion of the coursework aspect of the M.Sc. programmes a student is required to take and pass all the taught core courses (24 CU) and a minimum of six (6) CU of elective courses.

b. Research: Research for the M. Sc Degree normally takes 12-18 months to complete. The research may run concurrently with some credit courses from the second semester of the study or after the first one year of course work.

c. Seminar / Examination

Candidate must demonstrate orally complete mastery of basic theoretical biochemistry as well as successfully defend his/her research findings and dissertation before a panel of internal and external examiners.

***COURSE STRUCTURE*:**

Course Code	Course Title	Credit Units
FIRST SEMESTER		
CORE		
SCI 801	Management and Entrepreneurship	2
BTEC841	GENERAL BIOCHEMISTRY	2
BTEC843	GENERAL MICROBIOLOGY	2
BTEC845	MOLECULAR BIOLOGY & RECOMBINANT DNA TECHNOLOGY	3
FBTE709	PRINCIPLES OF FORENSIC SCIENCES	2
BTEC847	BIOSAFETY	2
BTEC849	CELL AND TISSUE CULTURE	2
BTEC851	BIOTECHNOLOGY LABORATORY I	2
BTEC853	COLLOQUIUM (SEMINARS)	3
BTEC893	RESEARCH/THESIS	6
SECOND SEMESTER		
CORE		
SCI 802	ICT AND RESEARCH METHODOLOGY	2

BTEC842	BIOETHICS	2
BTEC844	BIOENTREPRENEURSHIP & INTELLECTUAL PROPERTY	2
BTEC846	BIOINFORMATICS	2
BTEC848	BIOENGINEERING	2
BTEC850	RESEARCH METHODOLOGY and BIOSTATISTICS	2
BTEC852	BIOTECHNOLOGY LABORATORY II	2
BTEC896	RESEARCH PROJECTS	6
ELECTIVES		
BTEC854	AGRICULTURAL BIOTECHNOLOGY	2
BTEC856	MEDICAL & PHARMACEUTICAL BIOTECHNOLOGY	2
BTEC858	INDUSTRIAL & ENVIRONMENTAL BIOTECHNOLOGY	2
BTEC853	RECENT ADVANCES IN BIOTECHNOLOGY	2
NUTR 862	NUTRITIONAL GENOMICS	2
BTEC 846	BIOINFORMATICS	3
PHCL 815	TOXICOLOGY	3
MICR 809	ADVANCED INDUSTRIAL MICROBIOLOGY	4
BIOL863	BIOMASS/RESOURCE UTILIZATION	3
THIRD AND FOURTH SEMESTERS		
CONCLUSION OF RESEARCH PROJECT, SEMINAR AND WRITE – UP OF THESIS		

Others Electives may be taken from departments such as: Chemical Engineering, Anatomy, Chemistry, Microbiology, Pharmacology etc. subject to approval by the Department. But for M.Sc. programmes, unrestricted electives may not exceed a maximum of 9CU.

COURSE CONTENT

FIRST SEMESTER

SCI801: MANAGEMENT AND ENTREPRENEURSHIP

BTEC841: GENERAL BIOCHEMISTRY: Overview of basic protein, nucleic acids, lipid and carbohydrate chemistry. Methods of purification and characterization of proteins; Enzymes & their kinetics; Intermediary metabolism and regulation **[3CU]**

BTEC843: GENERAL MICROBIOLOGY: Study of viruses, bacteria and other microorganism with regards to the basic biochemistry & molecular biology, epidemiological and clinical aspects. Methods of microbial amplification; Bacterial cultures and media preparation **[2CU]**

BTEC845: MOLECULAR BIOLOGY & RECOMBINANT DNA TECHNOLOGY: The cellular organization and sub cellular structure / organelles. Cell cycle and cell division; Sites of macromolecular synthesis transport across cell membranes, cell to cell signaling, cell adhesion; Central dogma, gene expression & organization; Functional genomic, gene mapping and application. Isolation and purification of DNA from cells; Restriction enzymes; RFLP; Introduction of DNA to living cells; Cloning strategies; Northern, Western and Southern blotting; Use of molecular markers in microbial, plant & animal systems, forensics & diagnostics. **[3CU]**

BTEC847: BIOSAFETY: Good laboratory practice. Hazardous materials (toxic and bio-harzadous materials) handling and disposal. Rules and regulations governing usage and shipping of hazardous materials. Rules and regulations on genetically modified foods and organisms and their disposal. Biosafety practices and regulations **[2CU]**

BTEC849: CELL AND TISSUE CULTURE: Aseptic techniques, preparation of culture media, seed sterilization, and micro propagation. Direct and indirect organogenesis, non-zygotic embryogenesis, callus culture establishment from explants embryo culture and embryo rescue, meristem culture; In-vivo techniques, production of polyclonal and monoclonal antibodies; Mammalian embryo fusion, transfer of single genes in zygotes and blastomeres using reporter sequences and in-vitro fertilization, Primary cell culture technique, Cell lineages, Stem cell culture techniques, Strategies to authenticate cultures and avoid cell line misidentification and cross-contamination, Enzymatic techniques for tissue dissociation, clinical applications of cultured cells, Cytochemical staining methods, Cell sorting, cryopreservation of cells, **[3CU]**

BTEC851: BIOTECHNOLOGY LABORATORY I:

Qualitative tests for basic biomolecules (carbohydrates, nucleic acids, proteins and lipids. Protein purification and protein assays. Enzyme purification and enzyme assay. Nucleic acid isolation and purification **[2CU]**

FBTE709: Principles of Forensic Sciences: Introduction to Forensic Sciences (definitions, divisions of forensics), Biological specimens (identification, uses & applications). **(2CU).**

SECOND SEMESTER

SCI802: ICT AND RESEARCH METHODOLOGY

BTEC842: BIOETHICS: Definitions, moral, legal and religious concerns; Risks and benefits; Ethical dilemma pertaining to DNA technologies, stem cell research, human genome project, cloning and the use of Genetically Modified Organisms. Regulation of environmental application of genetically engineered organisms. Guidelines for the release of GMO. Informed consent of humans and the use of animal models in research **[2CU]**

BTEC844: BIOENTREPRENEURSHIP & INTELLECTUAL PROPERTY RIGHTS:
Tactical approaches used in marketing of biotechnology products and services. Establishing a biotechnology company; Patents and licensing issues; International laws and agreement relating to production of biotechnological inventions; Legal issues on the protection of biotechnological

inventions and patents; Detection & identification of GMO and their control, containment facilities, authorship, plagiarism and peer review in science. **[2CU]**

BTEC846: BIOINFORMATICS: Definitions and terminologies. Basic web surfing and the use of softwares for DNA and Protein sequence analysis; Databases of genomes and proteins; Tools for processing genomic / protein databases; Database searching and analysis; Sequence homology search, multiple alignment and protein sequence motif alignment; Information retrieval and interpretation; Introduction to Microarrays and Phylogenetic analysis **[3CU]**

BTEC848: BIOENGINEERING: Bioprocessing, Bioreactor Design and Operations, methods of analysis and optimization of bioreactor processes, modes of reactor operation (batch, feed batch, continuous and perfusion systems) Scale–up processes and strategies, centrifugation, freeze drying and chromatographic techniques. Transport phenomena in organic and biotech. Systems (mass transfer, separation, agitation, mixing and rheology); Estimation of metabolism in bioprocessing using simultaneous separation and biosensor technology **[2CU]**

BTEC850: RESEARCH METHODOLOGY and BIOSTATISTICS: Characteristics of research and types of research. Ethical issues in different stages of research; Principles of statistics in planning and experimental design; Sampling and sampling methods; Data collection methods, presentations and analysis; Hypotheses formulation and testing **[2CU]**

BTEC852: BIOTECHNOLOGY LABORATORY II: Basic cloning techniques such as isolation, digestion, & ligation of DNA; PCR, Southern and Northern Blotting, SDS PAGE; Transformation of competent bacterial cells **[2CU]**

BTEC896: RESEARCH PROJECTS: Each student will be given a research project topic at the end of the first semester and is expected to submit a dissertation on it at the end of the course **[12 CU].**

PRESCRIBED ELECTIVES

BTEC854, BTEC856 & BTEC858 APPLIED BIOTECHNOLOGY:

Choose one according to specialization:

BTEC854: Agricultural Biotechnology(4CU): Genetic transformation of plant and animal cells and generation of stably transformed organisms; Production of transgenic plants with resistance to pest, diseases or herbicides; Micro propagation techniques; Role of biotechnology in animal production and improvement of animal health; Aqua culture and biotechnology.

BTEC856: Medical & Pharmaceutical Biotechnology (4CU) : Principles of gene therapy and vaccine technology; Stem cell research; gene knockout; RNA interference; disease immunology; Pharmacological gene reactivation, Hybridoma technology & monoclonal antibodies; PCR based diagnostics. Facility design and drug development; Drug Targeting; Vaccine production; Pharmacogenomics; Quality control and assurance issues; Marketing of biotechnological pharmaceutical products.

BTEC858: Industrial & Environmental Biotechnology (2CU): Enzyme reaction and kinetics, Enzyme purification and characterization; Industrial application of enzymes, immobilized enzymes and applications; Fermentation principles; Good manufacturing practice; Quality control and assurance. Rules and regulations of environmental protection; Biodiversity; Bioremediation; Release and impact of genetically modified organisms on the environment; Waste treatment and Quality Audit certification.

ELECTIVES

BTEC853: RECENT ADVANCES IN BIOTECHNOLOGY:

Topical issues in Biotechnology (Term paper) **[2CU]**

BCHM862: Nutritional Genomics, Evolution and Environment (2CU)

Metabolism of nucleic acids, their role in the structure and physiological functions of the body. Basic biochemistry and cell biology related to processes involved in protein synthesis and degradation and the regulation of these processes and their relevance to human nutrition. The fundamental concepts of eukaryotic DNA structure, function and gene expression with reference to their importance in regulating metabolism and the impact of a changing nutrient environment.

Factors and pathways that can modulate toxic effects, including poly morphic drug-metabolizing enzymes, stress-activated signal transduction, and DNA repair.

VMSM847: Advanced Clinical Onocology (3CU)

The course is designed to acquaint postgraduate students with the general principles and advances in clinical oncology, specifically, staging of tumors, tumors biology immunology, clinical evaluation clinical diagnosis and management of selected neoplastic conditions e. g leukemia , transmissible veneral tumours, mammary tumours, osteosarcoma and mast cell tumours will be discussed. Therapy.

PHCL815: Toxicology (3CU)

Introductory toxicology, fate of toxic agents in the body, Insecticides, Herbicides and other pesticides. Food toxicology, phytotoxicology, Snake venom and other toxins of animal origin. Heavy metal and Industrial toxicology. Alcohol, tobaco and other social poisons. Solvent, vapor and gasses Toxicology of cosmetics, toxicology of radiation and radioactive materials. Systemic toxicology, Forensic toxicology, Veterinary toxicology, techniques and research methods in toxicology, career opportunities in toxicology.

MIC809: Advanced Industrial Microbiology(3CU)

Growth techniques of industrial microorganisms, culture systems, Industrial Microorganisms and Product formation Fermentation systems Microbial bioconversions. Industrial waste disposal; Genetic of Industrial microorganisms.

BIOL863: **BIOMASS/RESOURCE UTILIZATION (3CU)**

DOCTOR OF PHILOSOPHY (PhD) IN BIOTECHNOLOGY

M. Phil/PhD Biotechnology

Admission Requirement

i. Applicants must have five (5) credit passes including English language, Mathematics, Biology, Chemistry and Physics.
ii. An applicant who already holds the M.Sc. degree in Biochemistry or any of the Natural Sciences or MSc in Biotechnology, may be considered for direct admission into the Ph.D. Biotechnology programme if the applicant's M.Sc. is considered equivalent to that of Ahmadu Bello University's department of Biochemistry and must have scored a minimum CGPA of 4.0/5.0 and Thesis score not less than 60% (B). Candidates that meet these requirements but have not passed any of the core courses in the M.Sc. programme in this department shall be required to register and pass at 'B' grade such courses.
iii. Candidates in the following categories will be required to enroll for the M. Phil. programme and may be allowed to proceed for the Ph.D. programme after successful completion of the M. Phil. programme:

a) A candidate who's CGPA at the Master degree level is less than 4.0/5.0 but not lower than 3.5/5.
b) A candidate who's Master degree programme did not include a thesis component.
c) A candidate who has a Master degree not in Biochemistry but a closely related field.

iv. At least two favorable letters of recommendation, one of which must be from the applicant's previous academic advisor.

NOTE: A candidate who does not meet the requirement for upgrading of M. Phil programme to a Ph.D. shall be advised to withdraw.

Duration of Programme

The progarmme shall run for a minimum of SIX (6) semesters and a maximum of NINE (9) semesters.

Graduation Requirement

a. Course work

i. A Ph.D. candidate is expected to register and pass a minimum of 45CU, but not exceeding 60CU (including Seminar and Dissertation). A 'B' grade shall be considered a pass for Ph.D. candidates.
ii. A Ph.D. candidate shall present at least three (3) Seminars.
iii. Ph.D. candidates unable to conclude their study within the stipulated time but have earned a minimum of 40CU of course work (excluding Seminar and Research credits) and have conducted enough research work for a Project/Thesis.

b. Research/Examination

Candidate must demonstrate orally complete mastery of basic theoretical biochemistry as well as successfully defend his/her research dissertation before a panel of internal and external examiners.

COURSE STRUCTURE

Course Code	**Course Title**	**Credit Units**
BCHM901	COMPUTER APPRECIATION FOR RESEARCH STUDENTS	3
BTEC 901	MOLECULAR EVOLUTION	3
BTEC 903	MODERN CONCEPTS IN CANCER & CARCINOGENESIS	3
BTEC 905	BIOCHEMISTRY OF TROPICAL PARASITES & DISEASE AGENTS	3
BTEC 907	JOURNAL CLUB	2
BTEC 981	SEMINAR I (PROPOSAL DEFENCE)	2
BTEC982	SEMINAR II (PROGRESS REPORT)	2
BTEC983	SEMINAR III (FINAL REPORT)	2
BTEC993	RESEARCH/DISSERTATION	12

COURSE CONTENT

BCHM 901: Computer Appreciation for Research Students (3CU)

Basic trainings in DOS/Windows, Word processing, Spread sheet, graphic, Chemdraw, Statistics, presentation (e.g Power point) A diploma in the programs from Iya Abubakar Computer Center or any other Computer training school acceptable to the department shall suffice.

BTEC901: Molecular Evolution (3CU)

Molecular evolution mechanism of evolution from a comparative analysis of genes and genomes, phylogenetics, phylogeny and DNA hybridization, phylogeny and DNA sequence comparison; Evolution of multigene families; Rates of molecular evolution and acquisition of new functions; gene transfer in nature; selfish DNA.

BTEC903: Modern Concepts in Cancer and Carcinogenesls (3 CU)

Broad overview, Cancer and carcinogenesis, causes of cancer, mechanism of mutagenesis and carcinogenesis. Cancer susceptibility and risk assessment; Anticancer agents; Metabolic polymorphism and susceptibility to cancer, carcinogenesis and biological effects of tumor; Introduction to cancer epidemiology; Biomarkers and cancer epidemiology; Long term and short term assays for carcinogens. Cancer therapy, surgery and techniques in cancer research.

BTEC905: Biochemistry of Tropical Parasites and Disease Agents (3 CU): Parasites enzymology, recent development in immunity to parasites of medical importance including Plasmodium, trypanosomes, Cryptosporidium, Toxoplasma, filarial, rabies, schistosomes and trichinelia, bacterial and viral diseases agents.

BTEC907: Journal Club (2CU): Journal club, Compulsory seminar, current trends in biochemistry, Discussion on papers from high impact journals; Journal of Biological chemistry(JBC), Biochemical Journal (BJ), Cell Biochemistry and Function(CBF), European Journal of Biochemistry(EJB) Biochemistry, Journal of Biochemistry(JB), Nature, Science, Cell, Plus One, EMBO, Plos-NTDs

ACADEMIC STAFF

Name	Qualification and rank	Specialty
Prof M. N. Shuaibu	BSc, MSc, PhD (Prof)	Molecular Parasitology, and Bioinformatics, Immunology and Vaccinology
Prof A. J. Nok	BSc, MSc. PhD (Prof)	Enzymology, Medical Biochemistry and Biotechnology
Prof J.K.P. Kwaga	DVM, MSc. PhD (Prof)	Molecular Genetics & Epidemiology
Prof. J. Kabir	DVM, MSc. PhD (Prof)	Epidemiology and Biotechnology
Prof Y.K.E. Ibrahim	BSc, MSc. Dr. sc. hum (Prof)	Bacterial Genetics & Molecular Epidemiology
Prof I.S. Ndams	BSc, MSc. PhD (Prof)	Molecular Parasitology, Bioinformatics and Biostatistics
Prof H. M. Inuwa	BSc, MSc. PhD (Prof)	Plant Gene Expression & Medical Biotechnology
Prof. M. Mamman	DVM, MSc, PhD (Prof)	Veterinary Biotechnology
Prof. A. I. Mamman	MBBS, MSc, PhD (Prof)	Medical Epidemiology and Biotechnology
Prof. I. A. Umar	BSc, MSc. PhD (Prof)	Medical Biochemistry and Medicinal Plants

Prof. D. A. Ameh	BSc, MSc. PhD (Prof)	Food Biochemistry and Nutritional Genomics
Prof S. E. Atawodi	BSc, MSc, PhD (Prof)	Medical Biochemistry and Medicinal Plants
Dr. H. Makun	DVM, MSc. PhD (Reader)	Molecular Helminthology
Dr A. B. Sallau	BSc, MSc. PhD (Reader)	Biotechnology, Enzymology
Dr A. Salihu	BSc, MSc, PhD (Senior Lecturer)	Biotechnology
Dr. A. M. Musa	BSc, MSc. PhD (Senior Lecturer)	Biotechnology
Dr A. B. Ibrahim	BSc, MSc, PhD (Senior Lecturer)	Biotechnology
Dr E. O. Balogun	BSc, MSc, PhD (Senior Lecturer)	Molecular Parasitology and Enzymology
Dr Auwal Ibrahim	BSc, MSc. PhD (Lecturer I)	Biotechnology
Prof. Dr K. Soerge+	BSc, MSc. PhD (Prof)	Biotechnology
Dr Stella Smith+	BSc, MSc. PhD	Biotechnology
Dr Dan Achukwi+	BSc, MSc. PhD (Prof)	Biotechnology & Epidemiology
Dr Gloria Chechet	BSc, MSc, PhD (Lecturer.I)	Biotechnology & Epidemiology
Dr Idowu Aimola	BSc, MSc, PhD (Lecturer I)	Human gene expression, Medical Biotechnology
Dr Aliyu Muhammad	BSc, MSc, PhD (Lecturer I)	Medical Biotechnology
Dr A Mohammed	BSc, MSc, PhD (Lecturer I)	Medical Biochemistry and Medicinal Plants
Dr Awwal Garba	BSc, MSc, PhD (Lecturer I)	Industrial Biotechnology
Dr S. B. Mada	BSc, MSc, PhD (Lecturer I)	Medical Biochemistry
Dr O. O. Okubanjo	DVM, MSc, PhD (Reader)	Parasitology and Entomology
Dr. S. A Yila	DVM, MSc, PhD (Reader)	Virology and Molecular Biology
Dr. T. T. Gbem	BSc, MSc, PhD (Senior Lecturer)	Molecular Biology

+ Research associates

ENQUIRIES AND CORRESPONDENCE

All enquiries and correspondences concerning and regarding information about the postgraduate Biotechnology programmes of the department should be directed to:

Prof Y. K. E. Ibrahim

The Centre Leader

ACENTDFB

Or to

Department of Biochemistry

Ahmadu Bello University

Zaria-Nigeria