* Syllabus and Evaluation Scheme *

for

Pre PhD Course Work

Department of Biotechnology
Chaudhary Bansi Lal University, Bhiwani

(A State University established under Haryana Act No. 25 of 2014)

(2019-20)

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Syllabus and evaluation scheme
Pre PhD course work in Biotechnology

Summary

Programme	:	Pre PhD course work in Biotechnology
Duration	:	1-2 Semesters
Minimum Attendance Required	:	**75%** in individual course
Total Credits	:	**12**
Total Marks	:	**300**

Paper Code	Subjects	Credits	Contact hrs per week	Internal assessment marks	Final Semester Exam Marks	Total	Mode of evaluation
19BTPh 1001	Research Methodology	4	4	20	80	100	Internal
19BTPh 1002	Review of Literature	4	4	-	100	100	Internal and External
19BTPh1003	Recent advances in Biotechnology	4	4	20	80	100	Internal
TOTAL		**12**	**8**	**40**	**260**	**300**	

Duration of Examination:

Minor Test	Major Test	Seminar
1-1.5 hr	3 hr	0.5h

To qualify the course, a student is required to secure a minimum of 55% marks in aggregate including the internal evaluation and Major Test (End Semester Examination). For details please see the PhD ordinance of the University.

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PhD Course work
Department of Biotechnology

19BTPh 1001
Research methodology

Maximum Marks: 100
Theory Examination: 80
Internal Assessment: 20

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives and outcome of the course:
This course will develop scientific aptitude in the students. Here the student will learn the ways to identify problem and based on existing evidences they will be able to develop hypothesis, designing critical scientific methodology to find the solution and explanation to the problem.

Unit I

Identification and defining of the research problem: Familiarization of research areas; reading and interpretation of research papers; critical analyses of research problems; use of tools for searching literature through electronic databases; research design, sampling, patent search.

Unit II

Experimental approaches and methodology: Meaning, objectives, types and significance of research; necessity and techniques of defining research problem; formulation of research problem; objectives of research problem; features of good research design; types of research designs, basic principles of experimental designs, design of experiments; census and sample surveys; different types of sample designs; characteristics of good sample design; techniques of selecting a random sample.

Unit III

Ethics in biological research: Guidelines for biosafety and bioethics; institutional biosafety committee; handling of genetically modified organisms; institutional human and animal ethics committee; compliance, concerns and approvals; copyright, royalty, intellectual property rights and patent laws; reproduction of published material and plagiarism; citation and acknowledgements; reproducibility and accountability; conflict of interest; safety practices and disposal of bio-waste in the laboratory; radioactivity and safety precautions; handling and disposal of flammable and hazardous chemicals.

Unit IV

Presentation and publication skills: Skills for scientific writing and research presentation: term paper, research project, research report, thesis, research article and review; Use of electronic tools for bibliographic formatting and checking plagiarism; oral presentation skills.

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PhD Course work
Department of Biotechnology

19BTPh1002
Review of Literature

Maximum Marks: 100

Objectives and scope of the course:
This course will help the student to learn about the basic introduction and literature related to the area of research. The student will search the available literature and cited references to develop a background in the direction of pursuing the research. The search topic will be decided by the Department research committee (DRC). The student will deliver a mid semester seminar to the department. End semester report duly checked and verified for plagiarism by the available software at University website will also be submitted by the candidate. The acceptance of the plagiarism in the report will be as per the norms of PhD thesis guideline of the University. The plagiarism report will be appended with the submission. The progress report will be associated with a soft copy to DRC, seminar and viva voce.

The evaluation scheme will be following:

a. Attendance (Minimum attendance required 75%)

Total Attendance (%)	Marks Awarded (Max marks 5)
>75-80	02
>80-85	03
>85-90	04
>90	5

b. Mid semester seminar - 15 Marks
c. End semester reports - 50 Marks
End semester seminar - 30 Marks

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PhD Course work
Department of Biotechnology

19BTPh1003
Trends in Biotechnology
Recent Advances

Maximum Marks: 100
Theory Examination: 80
Internal Assessment: 20

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks. The evaluation will be carried internally by the department.*

Objectives and outcomes of the course:
This course will impart the advanced knowledge of core biotechnology related subjects that are essential for performing the research in specific thrust area of the department.

The syllabus will have a dynamic design based on exclusive four core course units from the list that is provided below. Importantly, the Unit I will be compulsory in addition to any other three units. **Each unit, except the Unit I, will also include the advanced research papers in the proposed area**.

For example, if unit I, unit II, unit III and unit IV are combined to design the syllabus for a particular student in a specific thrust area of research by the DRC then the subcode of the paper will be 19BTPh1234**.** Furthermore, if unit IV, unit VI, unit IX and unit X are combined to design the syllabus for a particular student then the subcode of the paper will be 19BTPh4690**.** In addition, for other combinations of units the subcode of the paper will change accordingly.

Course Units
Unit I: Fundamentals of Biostatics, Computer and Biotechniques
Unit II: Cell and Developmental Biology
Unit III: Biochemistry and Environmental Biotechnology
Unit IV: Animal and Plant Biotechnology
Unit V: Microbiology and Bioprocess Technology
Unit VI: Bioinformatics and Molecular Modelling
Unit VII: Immunology and Infectious Diseases
Unit VIII: Molecular Biology and Genetic Engineering
Unit IX Molecular Parasitology of Vector-borne Diseases
Unit X: Enzymology and Protein Engineering

Unit I: Fundamentals of Biostatics, Computer and Biotechniques

Fundamentals of computers; RAM, ROM, CPU, I/O devices. Operating systems. Use of MS Office, Power Point, WORD and EXCEL.

Univariate analysis (frequency tables, bar charts, pie charts, percentages), t-test, Chi-square test, correlation, p-value, ANOVA (analysis of variance).

Fluorescence, confocal, and electron microscopy; $FACS_{CAN}$ and cell sorter; HPLC; GC; gel electrophoresis and 2D-PAGE; NMR; electron spin resonance (ESR), mass spectrometry; PCR and its types; real time PCR; protein sequencing; microarrays (DNA and protein).

Unit II: Cell and Developmental Biology

Cell organelles structural and function; fluid mosaic model; mechanism of protein sorting and transport; chromatin organization; regulation of cell cycle; mechanisms of programmed cell death. Life cycle of *Drosophila*; molecular and cellular biology of fertilization; egg activation and early cleavages; pattern forming genes and expression in *Drosophila*; signal cascades for BMP and nodal during gastrulation; floral development in *Arabidopsis;* nuclear cloning and epigenetic reprogramming.

Unit III: Biochemistry and Environmental Biotechnology

Metabolism of carbohydrates, lipids and proteins; Ramachandran plot; enzyme kinetics; immobilized enzymes; biosynthesis and degradation of purines and pyrimidines. Methods of monitoring and controlling the pollution; effect of toxic chemicals on environment; thermal processing and energy recovery from organic waste; hospital and hazardous waste management; industrial effluents treatment with solar radiations; phytoremediation; biofertilizers; biopesticides.

Unit IV: Animal and Plant Biotech

Specialized lab equipments, media preparation, aseptic techniques and sterilization; primary culture of animal cells; viability and cytotoxicity assays; cell culture contamination; cryopreservation of cells; tissue engineering and its applications. Totipotency, regeneration and somatic embryogenesis in plants; germplasm conservation; distant and somatic hybridization; protoplast isolation and fusion; particle gun technology; molecular genetics of T-DNA transfer from *Agrobacterium* to plants.

Unit V: Microbiology and Bioprocess Technology

Molecular approaches for the identification of microorganisms; Bergey's manual of bacteriology; techniques to establish a pure culture; methods of sterilization; mathematical expression of growth; types of culture techniques; preservation of microbial cultures; strain improvement; extraction of fermented products; basic design of fermentor; production of antibiotics; food fermentations; mineral recovery using microbes; production of biofuels; methods for immobilization of enzymes; enzyme engineering.

Unit VI: Bioinformatics and Molecular Modelling

Various sequence file formats; introduction to PERL; biological databases, NCBI-Gen bank, EMBL, Swiss Prot, Plasmo DB, TIGR; dot matrix plots; CLUSTAL X/W; molecular phylogeny; PSI-BLAST and RPS-BLAST; concept of HMMS; protein structure databases PDB and MMDB; conformational parameters and predictions of protein secondary structure; methods of molecular modeling; technologies and strategies for drug discovery; personalized medicine; ligand based drug designing; QSAR, docking, ADMET.

Unit VII: Immunology and Infectious Diseases

Cardinal features of immune system; cells and effector molecules of the immune system; factors affecting immunogenicity; complement system; antigen processing and presentation; T cell activation; antibody engineering; reservoirs of infectious diseases and their modes of transmission; virulence factors of infectious agents; diagnosis of infectious diseases based on monoclonal antibodies, protein profiling and protein microarray; resistance against antibiotics; DNA vaccines; reverse vaccinology.

Unit VIII: Molecular Biology and Genetic Engineering

DNA replication, transcription and translation; transcription regulation and RNA modification; DNA repair; antisense RNA; RNA stability; histone modification, riboswitches; basic biology of plasmids, bacteriophage vectors, cosmids, phasmids, YAC and BAC; M13 and expression vectors; PCR based cloning; genetic

manipulation of plants; t-DNA and transposon tagging; gene silencing by RNAi; *In vitro* translation and refolding of recombinant proteins; site-directed mutagenesis and protein engineering.

UNIT IX: Molecular Parasitology and Vector-borne Diseases

Parasitism, Mutualism, Hyperparasitism; host-parasite specificity and interactions; parasitic (Morphological and Physiological) adaptations; origin and evolution of parasitism; life cycles of *Plasmodium, Leishmania, Toxoplasma;* life cycle of insect vectors transmitting *Plasmodium* and *Leishmania*; control of parasite development by vector innate immune pathways; mechanisms of parasite evasion of host immunity with special emphasis on *Plasmodium*; clinical and molecular diagnostics; control of vector borne diseases (specific to malaria).

Unit X Enzymology and Protein Engineering

Enzyme nomenclature and classification; substrate and reaction specificity; three point attachment hypothesis; factors affecting velocity of enzyme catalyzed reactions; Michaelis-Menten hypothesis; transformation of Michaelis-Menten equation and determination of Km and Vmax; Haldane relationship; enzymes inhibition i.e., reversible and irreversible inhibition, Competitive, Non-competitive and uncompetitive inhibition; allosteric and covalently regulated enzymes. Methods and applications of protein engineering; site directed mutagenesis; active site mapping; immobilized enzymes