Centre for Biodiversity Studies
School of Biosciences & Biotechnology
Baba Ghulam Shah Badshah University,
Rajouri – J&K. Pin-Code. 185 234

Dated: 19-05-2016

No. BGSBU/CBS/16/11032

The Deputy Registrar (Academic Affairs)
BGSB University
Rajouri

Madam,

Enclosed please find herewith the syllabus for M.Phil programme in respect of Mr. Basharat Ahmad Bhat pursuing M.Phil in Biotechnology during 2016.

The syllabus has been drawn as per statutory guidelines and wetted by M.Phil Committee. This is for further n/a at your end.

Thanking you,

Yours sincerely,

Director
Centre for Biodiversity Studies
B.G.S.B. University
Director, CBS 19/5/16
Rajouri

Encl: As stated above.

Syllabus for M.Phil (Biotechnology) Examination-2016

Credits: 04
Maximum Marks: 100
Duration: 3 hrs

Paper I: Research Methodology

Unit I: Fundamentals of a research programme

1.1 Introduction: meaning and definition, objectives of research, types of research.
1.2 Research problem: definition, necessity and techniques of defining research problems, formulation and objectives of research problem.
1.3 Research design: meaning, need and features of good research design, types of research design, basic principles of experimental design (RBD and CRD).
1.4 Sampling design: census and sample survey, different types of sampling designs, their characteristics and techniques.

Unit II: Scientific writing

2.1 Definition and basic concepts of scientific writing, significance & technique of research, finding & evaluating research material, guidelines of literature survey, record compilation.
2.2 Definition and kinds of scientific documents: research paper, review paper, book review, thesis, project reports.
2.3 Basic elements of research paper: title, authors, addresses, abstract, introduction, methods, results, discussion, acknowledgments, references, tables and figures.
2.4 Proposal preparation: instructions, submission to funding agency, manuscript submission.

Unit III: Microscopy and chromatography

3.1 Principles and application of light, phase contrast and fluorescence microscopy.
3.2 Principles, working and application of scanning and transmission electron microscopy.
3.3Types of chromatography: thin layer, column and high performance liquid chromatography (HPLC).
3.4 Principles and application of gel filtration, ion exchange and affinity chromatography.

Unit IV: Electrophoresis and centrifugation

4.1 Electrophoresis: types & principle, support media (agarose & polyacrylamide gels).

4.2 Electrophoresis of proteins: SDS-PAGE, native PAGE, isoelectric focussing gels, 2-D gel electrophoresis, detection, estimation & recovery of proteins from gels.

4.3 Electrophoresis of nucleic acids: agarose gel electrophoresis of DNA, DNA sequencing gels, pulse field gel electrophoresis (PFGE), electrophoresis of RNA.

4.4 Centrifugation: principle & types: differential, density gradient and ultracentrifugation.

Unit V: Nucleic acid isolation and purification

5.1 Methods for isolation of plant genomic DNA, quantification of DNA.

5.2 Recovery and purification of DNA from gels.

5.3 RNA isolation, purification and quantification, plasmid extraction and purification.

5.4 Nucleic acid blotting methods: southern, northern, western and dot blotting.

Note for Paper Setter:

The question paper will have 10 questions, two from each unit. The candidate will be required to attempt five questions in all, selecting one from each unit. All questions carry equal marks.

Syllabus for M.Phil (Biotechnology) Examination-2016

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Paper II: Plant Biotechnology

Unit I: Organisation of plant genome in chromosomes

1.1 Plant nuclear genomes: non-nuclear genomes, and DNA sequences.
1.2 Composition of nuclear DNA, genome size or nuclear DNA content, chromosome number and chromosome size.
1.3 Features of plant chromosome: centromere, euchromatin, heterochromatin, NOR, subtelomers and telomeres, significance of chromosome organisation.
1.4 Sex chromosomes and sex determination in plants.

Unit II: Estimation of plant genome

2.1 Techniques to measure chromosomal change: array comparative genome hybridisation & SNP microarrays.

2.2 Estimation of various components of higher plant genome: highly repetitive sequences, middle repetitive sequences and unique DNA sequences.

2.3 C- value paradox, range of interspecific and intra specific variation, origin of quantitative DNA variation.

2.4 Determination of genome size in plants: micro densitometry and flow cytometry.

Unit III: Plant gene transfer methods

3.1 Vectors: basic features of vectors for plant transformation, use of reporter genes in plant transformation.

3.2 Co- integrative and binary vectors, family of binary vectors.

3.3 Agrobacterium mediated gene transfer, Ti – plasmid features.

3.4 Direct gene transfer methods: particle bombardment, electroporation, PEG- mediated gene transfer.

Unit IV: Genetically modified crops

4.1 Bt – based genetic modification of plants: insect resistance, herbicide resistance.

4.2 Biotechnological approaches to disease resistance, protection against fungal pathogens, antimicrobial proteins.

4.3 Modification of plant nutritional content (vitamins, amino acids & lipids).

4.4 Modification of food plant taste and appearance (sweetness, starch & preventing discolouration).

Unit V: Molecular markers

5.1 Molecular markers: properties, types and applications; marker assisted selection.

5.2 RAPD, SSR & SNPs: methodology, principle, properties, advantages & limitations.

5.3 AFLP & MSAP: principle, methodology, properties, advantages & limitations.

5.4 Quantitative trait loci (QTL) mapping: introduction & types of mapping populations.

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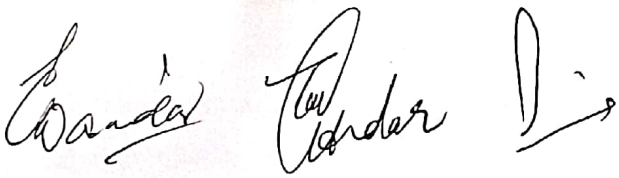

Syllabus for M.Phil (Biotechnology) Examination – 2016

Credits: 04
Maximum Marks: 100
Duration: 3 hrs

Paper III: Inheritance Biology

Unit I: Mendelian Principles and Extensions

1.1 Mendelian principles: dominance, segregation and independent assortment.
1.2 Entension of Mendelian principles: codominance, incomplete dominance, gene interaction, pleiotropy.
1.3 Genomic imprinting, penetrance and expressivity, phenocopy.
1.4 Mechanism of sex determination in Humans and Drosophila, dosage compensation.

Unit II: Inheritance and Mapping

2.1 Concept of gene, Allele, Multiple alleles, pseudoallele, complementation testes.

2.2 Crossing over: Cytological and molecular mechanism of crossing over.

2.3 Linkage maps, tetrad analysis, mapping with molecular marker, mapping by using somatic cell hybrids, development of mapping population in plants.

2.4 Extrachromosomal inheritance: inheritance of mitochondrial and choloroplast gene, maternal inheritance.

Unit III: Mutation and its effects

3.1 Types of mutations, causes, detection & application.

3.2 Mutant types: lethal, conditional, spontaneous verses induced mutations.

3.3 Phenotypic effects of mutation, somatic vs germinal mutation, suppressor mutation, biochemical loss of function and gain of function.

3.4 Molecular basis of mutation: radiation and chemical induced mutations.

Unit IV: structural and numerical changes of chromosomes

4.1 Deficiencies, duplications, inversions & translocations.

4.2 Chromosome aberration and evolution.

4.3 Polyploidy and their genetic implications, applications of polyploidy.

4.4 Induced polyploidy, polyploidy in plants, chromosome doubling in somatic and germ cells, experimental production of polyploids.

Unit V: Recombination and Transposition

5.1 Recombination: homologous and non-homologous recombination.

5.2 Molecular basis of homologous recombination, Holliday junction.

5.3 Site specific recombination, recombination in higher organism, cre-lox recombination.

5.4 Transposable elements: DNA transposons and retrotransposons, mechanism and functions of DNA and retrotransposons.

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Syllabus for M.Phil (Biotechnology) Examination-2016

Credits: 04
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Paper IV: Molecular Biology

Unit I: Nucleic acid structure and functions

1.1 Nucleic acids as information macromolecules, chemical and molecular structure of nucleic acids, types of DNA and RNA, Satellite, Repetitive and Unique DNA.
1.2 Denaturation and Renaturation: hyper and hypo-chromic effect, Denaturation curve, Tm, analysis of denaturation curve.
1.3 DNA supercoiling; underwinding of DNA, linking number of DNA, role of topoisomerases in changing the linking number of DNA.
1.4 Fundamental organizational units of chromatin: nucleosomes- structure and higher level of organization.

Unit II: DNA replication

2.1 Need for replication of DNA, semi-conservative, bidirectional and semi-discontinuous DNA replication.
2.2 Mechanism of DNA replication; enzymes and accessory proteins required in DNA replication of *E .coli* chromosome.
2.3 Replication of phage DNA and extrachromosomal DNA.
2.4 Replication of DNA in eukaryotes; enzymes and accessory proteins involved, control of replication.

Unit III: DNA repair and recombination

3.1 DNA repair mechanism; mismatch repair, base excision, nucleotide excision and direct repair.
3.2 Recombination: homologous recombination; Holiday junction; Proteins involved in recombination
3.3 Site specific recombination; *Cre-lox* recombination.
3.4 Mobile DNA; essential parts, insertional sequences, complex transposons, composite transposons.

Unit IV: Transcription

4.1 Transcription in prokaryotes; factors involved in transcription, mechanism (initiation, elongation and termination), antibiotic inhibitors of transcription in prokaryotes.
4.2 Operon concept; lactose, tryptophan and arabinose operons, bacteriophage lambda as an example of transcriptional riboswitches.

4.3 Transcription in eukaryotes; general and specific transcription factors, mechanism, enhancers and silencers and DNA binding motifs, antibiotic inhibitors of transcription in eukaryotes.

4.4 Post-transcriptional modifications in eukaryotes: 5' capping and polyadenylation, splicing; spliceosome machinery, alternate splicing, exon shuffling and RNA editing, Post-transcriptional gene control: concept of miRNA and siRNA.

Unit V: Translation

5.1 Genetic code- concept, degeneracy, triplet nature, deviation from universality and Wobble hypothesis.

5.2 Translation in prokaryotes; mechanism of initiation, elongation and termination, importance of co-transcriptional translation in prokaryotes.

5.3 Translation in eukaryotes; mechanism of initiation, elongation and termination, inhibitors of translation; antibiotics and toxins.

5.4 Post-translational modification of proteins; chemical modification and proteolytic cleavage, ubiquitin mediated protein degradation.

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