GITAM INSTITUTE OF TECHNOLOGY
GITAM UNIVERSITY

(Estd.u/s 3 of UGC Act, 1956)
Accredited by NAAC with 'A'Grade
Rushikonda, Visakhapatnam-530 045(AP)

GITAM Ph.D Admission Test - 2017

DEPARTMENT OF BIOTECHNOLOGY

Syllabus

Part A: Research Methodology

What is Research; Definitions, Research Process, Reasons for doing research, Outcome of Research, Sources of Research Ideas, Innovative Research, steps in Developing and Refining Research Problems, Basic vs applied research, Literature survey. Experimental Research, Experimental skills; Data analysis; Modeling skills Technical writing; Technical Presentations; Creativity in Research; Group discussion on Ethics in Research

Part B:
Section 1: General Biotechnology

Biochemistry: Biomolecules-structure and functions; Biological membranes, structure, action potential and transport processes; Enzymes- classification, kinetics and mechanism of action; Basic concepts and designs of metabolism (carbohydrates, lipids, amino acids and nucleic acids) photosynthesis, respiration and electron transport chain; Bioenergetics
Microbiology: Viruses- structure and classification; Microbial classification and diversity(bacterial, algal and fungal); Methods in microbiology; Microbial growth and nutrition; Aerobic and anaerobic respiration; Nitrogen fixation; Microbial diseases and host-pathogen interaction

Cell Biology: Prokaryotic and eukaryotic cell structure; Cell cycle and cell growth control; Cell-Cell communication, Cell signaling and signal transduction

Molecular Biology and Genetics: Molecular structure of genes and chromosomes; Mutations and mutagenesis; Nucleic acid replication, transcription, translation and their regulatory mechanisms in prokaryotes and eukaryotes; Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extra chromosomal inheritance; Microbial genetics (plasmids, transformation, transduction, conjugation); Horizontal gene transfer and Transposable elements; RNA interference; DNA damage and repair; Chromosomal variation; Molecular basis of genetic diseases
Analytical Techniques: Principles of microscopy-light, electron, fluorescent and confocal; Centrifugation- high speed and ultra; Principles of spectroscopy-UV, visible, CD, IR, FTIR, Raman, MS,NMR; Principles of chromatography- ion exchange, gel filtration, hydrophobic interaction, affinity, GC,HPLC, FPLC; Electrophoresis; Microarray

Immunology: History of Immunology; Innate, humoral and cell mediated immunity; Antigen; Antibody structure and function; Molecular basis of antibody diversity; Synthesis of antibody and secretion; Antigen-antibody reaction; Complement; Primary and secondary lymphoid organ; B and T cells and macrophages; Major histocompatibility complex (MHC); Antigen processing and presentation; Polyclonal and monoclonal antibody; Regulation of immune response; Immune tolerance; Hypersensitivity; Autoimmunity; Graft versus host reaction.

Bioinformatics: Major bioinformatic resources and search tools; Sequence and structure databases; Sequence analysis (biomolecular sequence file formats, scoring matrices, sequence alignment, phylogeny);Data mining and analytical tools for genomic and 11 of 72 proteomic studies; Molecular dynamics and simulations (basic concepts including force fields, protein-protein, protein-nucleic acid, protein-ligand interaction)

Section 2: Recombinant DNA Technology

Restriction and modification enzymes; Vectors; plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, yeast artificial chromosome; mammalian and plant expression vectors; cDNA and genomic DNA library; Gene isolation, cloning and expression ; Transposons and gene targeting; DNA labeling; DNA sequencing; Polymerase chain reactions; DNA fingerprinting; Southern and northern blotting; In-situ hybridization; RAPD, RFLP; Site-directed mutagenesis; Gene transfer technologies; Gene therapy

Section 3: Plant and Animal Biotechnology

Totipotency; Regeneration of plants; Plant growth regulators and elicitors; Tissue culture and Cell suspension culture system: methodology, kinetics of growth and, nutrient optimization; Production of secondary metabolites by plant suspension cultures; Hairy root culture; transgenic plants; Plant products of industrial importance Animal cell culture; media composition and growth conditions; Animal cell and tissue preservation; Anchorage and non-anchorage dependent cell culture; Kinetics of cell growth; Micro & macro-carrier culture; Hybridoma technology; Stem cell technology; Animal cloning; Transgenic animals

Section 4: Bioprocess Engineering and Process Biotechnology

Chemical engineering principles applied to biological system, Principle of reactor design, ideal and non-ideal multiphase bioreactors, mass and heat transfer; Rheology of fermentation fluids, Aeration and agitation; Media formulation and optimization; Kinetics of microbial growth, substrate utilization and product formation; Sterilization of air and media; Batch, fed-batch and continuous processes; Various types of microbial and enzyme reactors; Instrumentation control and optimization; Unit operations in solid-liquid separation and liquid-liquid extraction; Process scale-up, economics and feasibility analysis

Engineering principle of bioprocessing- Upstream production and downstream; Bioprocess design and development from lab to industrial scale; Microbial, animal and plant cell culture platforms; Production of biomass and primary/secondary metabolites; Biofuels, Bioplastics, industrial enzymes, antibiotics; Large scale production and purification of recombinant proteins; Industrial application of chromatographic and membrane based bioseparation methods; Immobilization of biocatalysts (enzymes and cells) for bioconversion processes; Bioremediation-Aerobic and anaerobic processes for stabilization of solid / liquid wastes

Model Question Paper - 2017

BIOTECHNOLOGY

Part – A: Research Methodology

Max Marks: 80

Summary, Writing and Citation Style **20 Marks**

Given checklist about Typographical, Plagiarism, References and Technical Content guidelines, write a summary (in 200 words) about your proposed research area of interest.

Multiple Choice Questions 20 Questions with 3 Marks Each **60 Marks**

Sample Questions

Q1) Assuming no modelling error, what is the effect of SNR on the quality of parameter estimates?

a) High value leads to poor estimates
b) High value leads to good estimates
c) Low value leads to poor estimates
d) None

Q2) In general, which of the following is used for linearizing a non-linear function?

a) Taylor's series expansion
b) Power series expansion
c) Fourier series expansion.
d) None of the above

Q3) Identify the methods for doing research

a) Transformation of facts
b) To test or disprove a theory
c) To come out with a better way
d) Information gathering

Part – B: Biotechnology

Max Marks: 80

Twenty Questions: Marks = 1 x 20 = 20 **20 Marks**

Q1. Choose the correct answer:
1) Action potential involves the action of myosin on actin
2) Action potential involves hydrolysis of ATP by kinesin to generate force
3) Action potential is the difference between the redox potential of the oxidized and reduced forms of a Cytochrome
4) Action potential involves local membrane depolarization

Q2. It was observed that a particular Type II restriction enzyme does not act on the DNA

of the bacterium that produced the enzyme. The following are possible:

1) The DNA has been methylated at the potential cleavage sites
2) The DNA sequence does not match the recognition element of the restriction enzyme
3) The enzyme has been inactivated
4) All of the above

Q3. Totipotency

1) causes necrosis
2) is required for regeneration of plants
3)is controlled by antibiotic concentration
4) is only present in haploid cells

Q4. The highest correspondence between design goals and experimental realization is for:

1) Ideal batch bioreactor design models
2) Ideal continuous flow bioreactor design models
3) Ideal fed-batch bioreactor design models
4) Non-ideal bioreactor design models

Twenty Questions: Marks = 3 x 20 = 60 **60 Marks**

Q1. An alpha-helical segment of a protein with five turns of the helix is stretched such that the end-to-end distance is 30A. The rise-per-residue in the resulting helix is:

1) 1.7 A
2) 3.6 A
3) 5.4 A
4) 6.0 A

Q2. CRISPER-Cas9 system is useful for

1) DNA sequencing
2) RAPD
3) RFLP
4) Gene therapy

Q3. Preferred organisms for production of antibiotics are ____ and interferons are _____

1) bacteria and fungi
2) fungi and mammalian cells
3) bacteria and mammalian cells
4) fungi and plant cells

Q4. BT-cotton is resistant to

1) *Bacillus thuringiensis*
2) boll weevils
3) draught
4) all pests