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FREE SYLLABUS

GATE BT 2027 Syllabus

The complete official syllabus for GATE Biotechnology (BT) 2027 in one clean list. Tick each topic as you finish it.

65
questions in **3 hours**, for **100 marks**.

85
marks from the **Biotechnology** syllabus.

13
marks (about) from **Engineering Mathematics**.

15
marks of **General Aptitude**, common to all GATE papers.

The GATE BT 2027 paper

Section	Questions	Marks
GA: General Aptitude	10	15
BT: Biotechnology syllabus (Sections 1 to 6), including about 13 marks of Engineering Mathematics	**55**	**85**
Total	**65**	**100**

Marking. MCQ (one correct option): a wrong answer costs 1/3 mark on a 1-mark question and 2/3 mark on a 2-mark question. MSQ (one or more correct options) and NAT (type a number): no negative marking.

Exam days. 6, 7, 13, 14, 20 and 21 February 2027. The BT date is not announced yet. **Result:** 19 March 2027.

Official syllabus, word for word. Every topic in this PDF is copied unchanged from the GATE 2027 Biotechnology (BT) and General Aptitude syllabi released by IIT Madras, the organizing institute. Checked on 31 October 2026. Official website: gate2027.iitm.ac.in

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- [ ] Tick a box when you finish a topic. All sections are compulsory in GATE BT.

GA General Aptitude

10 questions · 15 marks
Compulsory for every GATE paper

- [ ] **GA.1 Verbal Aptitude**

  Basic English grammar: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech. Basic vocabulary: words, idioms, and phrases in context. Reading and comprehension, Narrative sequencing.

- [ ] **GA.2 Quantitative Aptitude**

  Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data), 2-and 3-dimensional plots, maps, and tables. Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series. Mensuration and geometry, Elementary statistics and probability.

- [ ] **GA.3 Analytical Aptitude**

  Logic: deduction and induction, Analogy, Numerical relations and reasoning.

- [ ] **GA.4 Spatial Aptitude**

  Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping paper folding, cutting, and patterns in 2 and 3 dimensions.

SECTION 1 Engineering Mathematics

About 13 marks

- [ ] **1.1 Linear Algebra**

  Matrices and determinants; Systems of linear equations; Eigen values and Eigen vectors.

- [ ] **1.2 Calculus**

  Multivariable calculus (limits, continuity, and differentiability); Partial derivatives, maxima and minima; Sequences and series; Test for convergence. Multivariable calculus: Gradient, divergence, and curl (for applications in fluid mechanics, transport processes, etc.).

- [ ] **1.3 Differential Equations**

  Linear and nonlinear first order ODEs, higher order ODEs with constant coefficients; Cauchy's and Euler's equations; Laplace transforms.

- [ ] **1.4 Probability and Statistics**

  Mean, median, mode and standard deviation; Random variables; Poisson, normal and binomial distributions; Correlation and regression analysis; Bayesian Statistics.

- [ ] **1.5 Numerical Methods**

  Solution of linear and nonlinear algebraic equations; Integration by trapezoidal and Simpson's rule; Single step method for differential equations.

SECTION 2
General Biology

2.1 Biochemistry

Biomolecules - structure and function; Biological membranes - structure, membrane channels and pumps, molecular motors, action potential and transport processes; Basic concepts and regulation of metabolism of carbohydrates, lipids, amino acids and nucleic acids; Metabolism: Regulation of metabolism of carbohydrates, lipids, amino acids, and nucleic acids; Detailed pathways like glycolysis, citric acid cycle, and fatty acid oxidation; Photosynthesis, respiration and electron transport chain; Enzymes - Classification, catalytic and regulatory strategies; Enzyme kinetics - Michaelis-Menten equation; Enzyme inhibition - competitive, non-competitive and uncompetitive inhibition.

2.2 Microbiology

History of Microbiology, Bacterial classification and diversity; Bacterial cell wall composition, Gram positive and Gram-negative bacteria, Archea, Methods in microbiology; Microbial growth and nutrition; Operon- Lac, Trp and Ara operon, Nitrogen fixation; Microbial diseases and host-pathogen interactions; Antibiotics and antimicrobial resistance, Two-component system (TCS), bacterial communication, Viruses - structure and classification.

2.3 Immunology

Primary and Secondary lymphoid organs; Innate immunity and Inflammation; Cytokines and Chemokines; Complement system; Effector responses: Cellular and Humoral Immunity; Molecular basis of Antibody diversity and function; Polyclonal and Monoclonal antibodies; T-cell and B-cell development; Memory responses; Major Histocompatibility complex (MHC); Antigen processing and presentation; Regulation of immune responses; Immune tolerance; Hypersensitivity; Autoimmunity and Immunodeficiency; Graft vs Host disease; Immunization and vaccines.

SECTION 3
Genetics, Cellular and Molecular Biology

3.1 Genetics and Evolutionary Biology

Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extra chromosomal inheritance; Microbial genetics - transformation, transduction and conjugation; Bacterial gene mapping; Horizontal gene transfer and transposable elements; Chromosomal variation; Sex Determination; Genetic disorders; Population genetics; Epigenetics; Selection and inheritance; Adaptive and neutral evolution; Genetic drift; Species and speciation.

3.2 Cell Biology

Eukaryotic cell structure; Cell cycle and cell growth control; Cell-cell communication; Cell signalling and signal transduction; Non-cell autonomous cell signalling; Post-translational modifications; Protein trafficking; Cell death and autophagy; Extra-cellular matrix.

3.3 Molecular Biology

Molecular structure of genes and chromosomes; Mutations and mutagenesis; Regulation of gene expression; Nucleic acid - replication, transcription, splicing, translation and their regulatory mechanisms; Non-coding and micro RNA; RNA interference; DNA damage and repair

SECTION 4

Fundamentals of Biological Engineering

4.1 Bioreaction Engineering

Rate law, zero and first order kinetics; (More advanced kinetic models, including Michaelis-Menten kinetics for enzyme reactions. Inhibition kinetics : Competitive, non-competitive, and uncompetitive inhibition in enzyme catalysis); Ideal reactors - batch, mixed flow and plug flow; Enzyme immobilization, diffusion effects - Thiele modulus, effectiveness factor, Damkoehler number; Kinetics of cell growth, substrate utilization and product formation; Structured and unstructured models; Batch, fed-batch and continuous processes; Microbial and enzyme reactors; Optimization and scale up (Design and operation of microbial reactors (e.g., fermentation reactors) and enzyme reactors (e.g., immobilized enzyme systems); Case studies on the use of microbial reactors in large-scale production (e.g., antibiotics, biofuels).

4.2 Upstream and Downstream Processing

Media formulation and optimization; Sterilization of air and media; Filtration - membrane filtration, ultra filtration; Centrifugation - high speed and ultra; Cell disruption; Principles of chromatography - ion exchange, gel filtration, hydrophobic interaction, affinity, GC, HPLC and FPLC; Extraction, adsorption and drying; Measurement devices; Valves; First order and second order systems; Feedback and feed forward control; Types of controllers – proportional, derivative and integral control; Tuning of controllers.

SECTION 5

Plant, Animal and Microbial Biotechnology

5.1 Plants

Totipotency; Cell fate transition, direct and indirect organogenesis, 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; Hairy root culture; Plant products of industrial importance; Artificial seeds; Somaclonal variation; Protoplast, protoplast fusion - somatic hybrid and cybrid; Transgenic plants - direct and indirect methods of gene transfer techniques; Selection marker and reporter gene; Plastid transformation.

5.2 Animals

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; Knock-out and knock-in animals.

5.3 Microbes

Production of biomass and primary/secondary metabolites - Biofuels, bioplastics, industrial enzymes, antibiotics; Large scale production and purification of recombinant proteins and metabolites; Clinical-, food- and industrial- microbiology; Screening strategies for new products.

SECTION 6

Recombinant DNA technology and Other Tools in Biotechnology

6.1 Recombinant DNA technology

Restriction and modification enzymes; Vectors - plasmids, bacteriophage and other viral vectors, cosmids, Ti plasmid, bacterial and yeast artificial chromosomes; Expression vectors; cDNA and genomic DNA library Gene isolation and cloning, strategies for production of recombinant proteins; Transposons and gene targeting, Recombination-based gene cloning.

6.2 Molecular tools

Polymerase chain reaction; DNA/RNA labelling and Sangers and next generation sequencing; Southern and northern blotting; In-situ hybridization; DNA fingerprinting, RAPD, RFLP; Site-directed mutagenesis; CRISPR-Cas; Biosensing and biosensors; DNA-protein and protein-protein interaction tools; Genomics and proteomics-based approaches.

6.3 Analytical tools

Principles of microscopy - light, electron, fluorescence and confocal; Principles of spectroscopy - UV, visible, fluorescence, CD, IR, FT-IR, MS, NMR; Electrophoresis; Micro- arrays; Enzymatic assays; Immunoassays - ELISA, RIA, immunohistochemistry; Immunoblotting; Flow cytometry; Whole genome and ChIP sequencing.

6.4 Computational tools

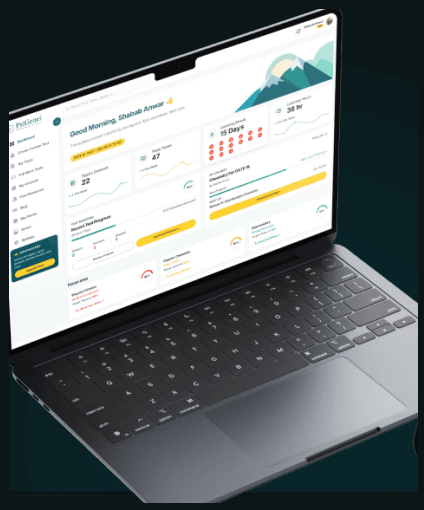
Bioinformatics resources and search tools; Sequence and structure databases; Sequence analysis - sequence file formats, scoring matrices, alignment, phylogeny; Genomics, proteomics, metabolomics; Gene prediction; Functional annotation; Secondary structure and 3D structure prediction; Knowledge discovery in biochemical databases; Metagenomics; Metabolic engineering and systems biology.

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- Time spent on each question
- Where you lost marks
- What to practice next

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