

CATALYST Center Of Excellence Pvt. Ltd. provides **Coaching/Test Series** (both Online and Offline) for **GATE** Examination in the following two subjects:-

- 1. Biotechnology (BT)**
- 2. Ecology and Evolution (EY)**

Pattern of Question Papers

The GATE examination consists of a single paper of **3-hour duration** that contains **65 questions** carrying a maximum of 100 marks, out of which 10 questions carrying a total of 15 marks are in General Aptitude (GA).

In the paper bearing the code **BT**, the Engineering Mathematics will carry around 13% of the total marks, the General Aptitude section will carry 15% of the total marks and the remaining percentage of the total marks is devoted to the subject of the paper.

In the paper bearing the code **EY**, the General Aptitude section will carry 15% of the total marks and the remaining 85% of the total marks is devoted to the subject of the paper.

The question paper would contain questions of two different types in various papers:

(i) **Multiple Choice Questions (MCQ)** carrying 1 or 2 marks each in all papers and sections. These questions are objective in nature, and each will have a choice of four answers, out of which the candidate has to mark the correct answer(s).

(ii) **Numerical Answer** Questions of 1 or 2 marks each in all papers and sections. For these questions the answer is a real number, to be entered by the candidate using the virtual keypad. No choices will be shown for this type of questions.

The examination for all the papers will be carried out in an ONLINE Computer Based Test (CBT) mode. The candidates are required to either select the answer (for MCQ type) or enter the answer for numerical answer type question using a mouse on a virtual keyboard (keyboard of the computer will be disabled). At the end of the 3-hour window, the computer will automatically close the screen from further actions.

Design of Questions

The questions in a paper may be designed to test the following abilities:

- (i) Recall**
- (ii) Comprehension**
- (iii) Application**

The questions based on the above logics may be a mix of single standalone statement/phrase/data type questions, combination of option codes type questions or match items type questions.

- (iv) Analysis and Synthesis**

Marking Scheme

All questions that are not attempted will result in zero marks. For **1-mark** multiple-choice questions, **1/3 marks will be deducted** for a wrong answer. Likewise, for **2-marks** multiple-choice questions, **2/3 marks** will be deducted for a wrong answer. **There is no negative marking for numerical answer type questions.**

General Aptitude (GA) Questions

In all papers, GA questions carry a total of 15 marks. The GA section includes 5 questions carrying 1 mark each (sub-total 5 marks) and 5 questions carrying 2 marks each (sub-total 10 marks).

Application Process:

All candidates have to apply via ONLINE only. For GATE all information related to the candidates' will be available in a single GATE Online Application Processing System (GOAPS). Candidates have to register/enroll and fill the application via ONLINE mode ONLY by accessing the zonal GATE websites of IISc and any of the seven IITs. The photograph and signature of the applicant must be uploaded during the online application. The application process becomes complete only when a printout of the filled ONLINE

application with the candidate's signature and a good quality photograph affixed in the appropriate place is received by the respective Zonal GATE offices along with necessary documents. Please note that application forms are not available for sale anywhere else.

Eligibility

Table: Minimum Eligibility Criteria for GATE 2014

Qualifying Degree (short)	Qualifying Degree/Examination (Descriptive)	Description of Eligible candidates	Year of Qualification cannot be later than	Copies of Certificates to be submitted	
				Passed in the year 2013 or earlier	Expected to complete in 2014 or later
B.E./B.Tech/ B.Arch/ B.Pharm.	Bachelor's degree in Engineering/ Technology/ Architecture/ Pharmacy (Post-Diploma/ Post B.Sc./4 years after 10+2)	Currently in the 4th year or already completed	2014	Degree Certificate/ Provisional Certificate/ Course Completion Certificate	Certificate from Principal
B.S	Bachelor's degree in Science (Post-Diploma/ 4 years after 10+2)	Currently in the 4th year or already completed	2014	Degree Certificate/ Provisional Certificate/ Course Completion Certificate	Certificate from Principal
M.Sc./M.A./ MCA or equivalent	Master's degree in any branch of Science/ Mathematics/ Statistics/ Computer Applications or equivalent	Currently in the final year or already completed	2014	Degree Certificate/ Provisional Certificate/ Course Completion Certificate (pertaining to Masters degree)	Certificate from Principal
Int. M.E/ M.Tech (Post BSc)	Post-BSc Integrated Master's degree programs in Engineering/ Technology (Four year programme)	Currently in the 2nd/3rd/4th year or already completed	2016	Degree Certificate/ Provisional Certificate/ Course Completion Certificate	Certificate from Principal
Int. M.E./M.Tech or Dual Degree (after Diploma or 10+2)	Integrated Master's degree programs or Dual Degree programs in Engineering/ Technology (Five year programme)	Currently in the 4th/5th year or already completed	2015	Degree Certificate/ Provisional Certificate/ Course Completion Certificate	Certificate from Principal
Int. M. Sc/ Int. B.S.-M.S.	Integrated M.Sc. or Five year integrated B.S.-M.S. program	Currently in the final year or already completed	2014	Degree Certificate / Provisional Certificate / Course Completion Certificate	Certificate from Principal
Professional Society Examinations (equivalent to B.E./B.Tech/B. Arch)	B.E./B.Tech/B.Arch. equivalent examinations, of Professional Societies, recognized by MHRD/ UPSC/ AICTE (e.g. AMIE by Institution of Engineers-India, AMICE by the Institute of Civil Engineers-India)	Completed Section A or equivalent of such professional courses	NA	Professional Certificate/ Provisional Certificate/ Course Completion/ Membership Certificate issued by the Society or Institute	Copy of Mark sheet for Section "A"

Certificate from Principal

Candidates who have to submit a certificate from their college Principal, as determined from the above table, have to obtain a signature from their Principal/HOD along with the seal on the "Certificate from the Principal" format that will be printed on the application PDF file which is generated after completion of the online application submission.

SYLLABUS

General Aptitude syllabus

Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Numerical Ability: Numerical computation, numerical estimation, numerical reasoning and data interpretation.

1. Biotechnology Syllabus

Linear Algebra: Matrices and determinants, Systems of linear equations, Eigen values and Eigen vectors. **Calculus:** Limit, continuity and differentiability, Partial derivatives, Maxima and minima, Sequences and series, Test for convergence, Fourier series.

Differential Equations: Linear and nonlinear first order ODEs, higher order ODEs with constant coefficients, Cauchy's and Euler's equations, Laplace transforms, PDE- Laplace, heat and wave equations.

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

Numerical Methods: Solution of linear and nonlinear algebraic equations, Integration of trapezoidal and Simpson's rule, Single and multistep methods for differential equations.

Microbiology: Prokaryotic and eukaryotic cell structure; Microbial nutrition, growth and control; Microbial metabolism (aerobic and anaerobic respiration, photosynthesis); Nitrogen fixation; Chemical basis of mutations and mutagens; Microbial genetics (plasmids, transformation, transduction, conjugation); Microbial diversity and characteristic features; Viruses.

Biochemistry: Biomolecules and their conformation; Ramachandran map; Weak inter-molecular interactions in biomacromolecules; Chemical and functional nature of enzymes; Kinetics of single substrate and bi-substrate enzyme catalyzed reactions; Bioenergetics; Metabolism (Glycolysis, TCA and Oxidative phosphorylation); Membrane transport and pumps; Cell cycle and cell growth control; Cell signaling and signal transduction; Biochemical and biophysical techniques for macromolecular analysis.

Molecular Biology and Genetics: Molecular structure of genes and chromosomes; DNA replication and control; Transcription and its control; Translational processes; Regulatory controls in prokaryotes and eukaryotes; Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extrachromosomal inheritance; Chromosomal variation; Population genetics; Transposable elements, Molecular basis of genetic diseases and applications.

Process Biotechnology: Bioprocess technology for the production of cell biomass and primary/secondary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, exo-polysaccharides, antibiotics and pigments etc.; Microbial production, purification and bioprocess application(s) of industrial enzymes; Production and purification of recombinant proteins on a large scale; Chromatographic and membrane based bioseparation methods; Immobilization of enzymes and cells and their application for bioconversion processes. Aerobic and anaerobic biological processes for stabilization of solid / liquid wastes; Bioremediation.

Bioprocess Engineering: Kinetics of microbial growth, substrate utilization and product formation; Simple structured models; Sterilization of air and media; Batch, fed-batch and continuous processes; Aeration and agitation; Mass transfer in bioreactors; Rheology of fermentation fluids; Scale-up concepts; Design of fermentation media; Various types of microbial and enzyme reactors; Instrumentation in bioreactors.

Plant and Animal Biotechnology: Special features and organization of plant cells; Totipotency; Regeneration of plants; Plant products of industrial importance; Biochemistry of major metabolic pathways and products; Autotrophic and heterotrophic growth; Plant growth regulators and elicitors; Cell suspension culture development: methodology, kinetics of growth and production formation, nutrient optimization; Production of secondary metabolites by plant suspension cultures; Hairy root cultures and their cultivation. Techniques in raising transgenics.

Characteristics of animal cells: Metabolism, regulation and nutritional requirements for mass cultivation of animal cell cultures; Kinetics of cell growth and product formation and effect of shear force; Product and substrate transport; Micro & macro-carrier culture; Hybridoma technology; Live stock improvement; Cloning in animals; Genetic engineering in animal cell culture; Animal cell preservation.

Immunology: The origin of immunology; Inherent immunity; Humoral and cell mediated immunity; Primary and secondary lymphoid organ; Antigen; B and T cells and Macrophages; Major histocompatibility complex (MHC); Antigen processing and

presentation; Synthesis of antibody and secretion; Molecular basis of antibody diversity; Polyclonal and monoclonal antibody; Complement; Antigen-antibody reaction; Regulation of immune response; Immune tolerance; Hyper sensitivity; Autoimmunity; Graft versus host reaction.

Recombinant DNA Technology: Restriction and modification enzymes; Vectors: plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, yeast artificial chromosome; cDNA and genomic DNA library; Gene isolation; Gene cloning; Expression of cloned gene; 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.

Bioinformatics: Major bioinformatics resources (NCBI, EBI, ExPASy); Sequence and structure databases; Sequence analysis (biomolecular sequence file formats, scoring matrices, sequence alignment, phylogeny); Genomics and Proteomics (Large scale genome sequencing strategies; Comparative genomics; Understanding DNA microarrays and protein arrays); Molecular modeling and simulations (basic concepts including concept of force fields).

2. Ecology and Evolution Syllabus

Ecology: Population ecology; metapopulation dynamics; growth rates; density independent growth; density dependent growth; niche concept; Species interactions: Plant-animal interactions; mutualism, commensalism, competition and predation; trophic interactions; functional ecology; ecophysiology; behavioural ecology.

Community ecology: Community assembly, organization and evolution; biodiversity: species richness, evenness and diversity indices; endemism; species-area relationships; Ecosystem structure, function and services; nutrient cycles; biomes; habitat ecology; primary and secondary productivity; invasive species; global and climate change; applied ecology.

Evolution: Origin, evolution and diversification of life; natural selection; levels of selection. Types of selection (stabilizing, directional etc.); sexual selection; genetic drift; gene flow; adaptation; convergence; species concepts; Life history strategies; adaptive radiation; biogeography and evolutionary ecology;

Origin of genetic variation; Mendelian genetics; polygenic traits, linkage and recombination; epistasis, gene-environment interaction; heritability; population genetics;

Molecular evolution; molecular clocks; systems of classification: cladistics and phenetics; molecular systematics; gene expression and evolution.

Mathematics and Quantitative Ecology: Mathematics and statistics in ecology; Simple functions (linear, quadratic, exponential, logarithmic, etc); concept of derivatives and slope of a function; permutations and combinations; basic probability (probability of random events; sequences of events, etc); frequency distributions and their descriptive statistics (mean, variance, coefficient of variation, correlation, etc).

Statistical hypothesis testing: Concept of p-value; Type I and Type II error, test statistics like t-test and Chi-square test; basics of linear regression and ANOVA.

Behavioural Ecology: Classical ethology; neuroethology; evolutionary ethology; chemical, acoustic and visual signaling; Mating systems; sexual dimorphism; mate choice; parenting behaviour Competition; aggression; foraging behaviour; predator-prey interactions; Sociobiology: kin selection, altruism, costs and benefits of group-living.