VPM CLASSES

CSIR NET - MATHEMATICAL SCIENCE

EXAM INFORMATION

CSIR UGC NET

JUNIOR RESEARCH FELLOWSHIP AND LECTURERSHIP

VPM CLASSES

WhatsApp: 9001894070 Email: info@vpmclasses.com

CSIR UGC NET

- The Council of Scientific and Industrial Research (CSIR) has entrusted the responsibility of conducting CSIR-UGC NET in **CBT mode** to NTA.
- CSIR-UGC NET is a test being conducted to determine the eligibility for ***Junior Research Fellowship (JRF)*** and for ***Lectureship (LS) /Assistant Professorship***' in Indian universities and colleges.
- CSIR-UGC NET Exam is conducted **twice a year (June & December)** all over India.
- CSIR NET Exam will be **Computer Based Test (CBT)** only.

ELIGIBILITY

- M.Sc or equivalent degree/ Integrated BS-MS/BS-4 years/BE/BTech/BPharma/MBBS with at least 55% marks for General (UR) and OBC candidates and 50% for SC/ST, Persons with Disability (PwD) candidates.
- Candidates enrolled for M.Sc. or having completed 10+2+3 years of the above qualifying examination as on the closing date of online submission of application form, are also eligible to apply in the above subject under the Result Awaited (RA) category on the condition that they complete the qualifying degree with requisite percentage of marks within the validity period of two years to avail the fellowship from the effective date of award.
- B.Sc.(Hons) or equivalent degree holders or students enrolled in Integrated MS-PhD program with at least 55% marks for General (UR) and OBC candidates; 50% marks for SC/ST, Persons with disability (PwD) candidates are also eligible to apply. Candidates with bachelor's degree will be eligible for CSIR fellowship only after getting registered/enrolled for PhD/Integrated PhD program within the validity period of two years.

AGE LIMIT

- **For JRF:** – Maximum 28 years as on 01-07-2020 {upper age limit may be relaxed up to 5 years in case of SC/ST/Persons with Disability(PwD)/female applicants and 03 years in case of OBC (non-creamy layer) applicants}.
- **For Lectureship (LS)/ Assistant Professorship:** - No age limit for it.

CSIR NET EXAM PATTERN

The pattern for the Single Paper MCQ test shall be as given below: -

PATTERN	PART A	PART B	PART C	TOTAL
TYPE	Common to all subjects	Subject - Related	Based on Knowledge & application of the Scientific Concepts	-
Total No. of Questions	20	40	60	120
Max. no. of Questions to be Attempted	15	25	20	60
Marks of Each Question	2	3	4.75	200
Negative Marking (25% for each wrong answer)	0.5	0.75	0	-

SYLLABUS

CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lecturer-ship
COMMON SYLLABUS FOR PART 'B' AND 'C'
MATHEMATICAL SCIENCES
UNIT – 1

Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum.

Sequences and series, convergence, limsup, liminf.

Bolzano Weierstrass theorem, Heine Borel theorem.

Continuity, uniform continuity, differentiability, mean value theorem.

Sequences and series of functions, uniform convergence.

Riemann sums and Riemann integral, Improper Integrals.

Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral.

Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems.

Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations.

Algebra of matrices, rank and determinant of matrices, linear equations.

Eigenvalues and eigenvectors, Cayley-Hamilton theorem.

Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms.

Inner product spaces, orthonormal basis.

Quadratic forms, reduction and classification of quadratic forms

UNIT – 2

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions.
Analytic functions, Cauchy-Riemann equations.

Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem.

Taylor series, Laurent series, calculus of residues.

Conformal mappings, Mobius transformations.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements.

Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø- function, primitive roots.

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems.

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain.

Polynomial rings and irreducibility criteria.

Fields, finite fields, field extensions, Galois Theory.

Topology: basis, dense sets, subspace and product topology, separation axioms, connectedness and compactness.

UNIT – 3

Ordinary Differential Equations (ODEs):

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs):

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs.

Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis :

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and

Runge-Kutta methods.

Calculus of Variations:

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differential equations.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

Classical Mechanics:

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

UNIT – 4

Descriptive statistics, exploratory data analysis

Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshef, Markov, Jensen). Modes of convergence, weak and strong laws of large numbers, Central Limit theorems (i.i.d. case).
Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution, Poisson and birth-and-death processes.

Standard discrete and continuous univariate distributions. sampling distributions, standard errors and asymptotic distributions, distribution of order statistics and range.

Methods of estimation, properties of estimators, confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.

Simple nonparametric tests for one and two sample problems, rank correlation and test for independence. Elementary Bayesian inference.

Gauss-Markov models, estimability of parameters, best linear unbiased estimators, confidence intervals, tests for linear hypotheses. Analysis of variance and covariance. Fixed, random and mixed effects models. Simple and multiple linear regression. Elementary regression diagnostics. Logistic regression.

Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms. Inference for parameters, partial and multiple correlation coefficients and related tests. Data reduction techniques: Principle component analysis, Discriminant analysis, Cluster analysis, Canonical correlation.

Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling. Ratio and regression methods.

Completely randomized designs, randomized block designs and Latin-square designs. Connectedness and orthogonality of block designs, BIBD. 2^K factorial experiments: confounding and construction.

Hazard function and failure rates, censoring and life testing, series and parallel systems.

Linear programming problem, simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.

All students are expected to answer questions from Unit I. Students in mathematics are expected to answer additional question from Unit II and III. Students with in statistics are expected to answer additional question from Unit IV.