VPM CLASSES

JNU

EXAM INFORMATION

Jawaharlal Nehru University Entrance Examination

(JNUEE)

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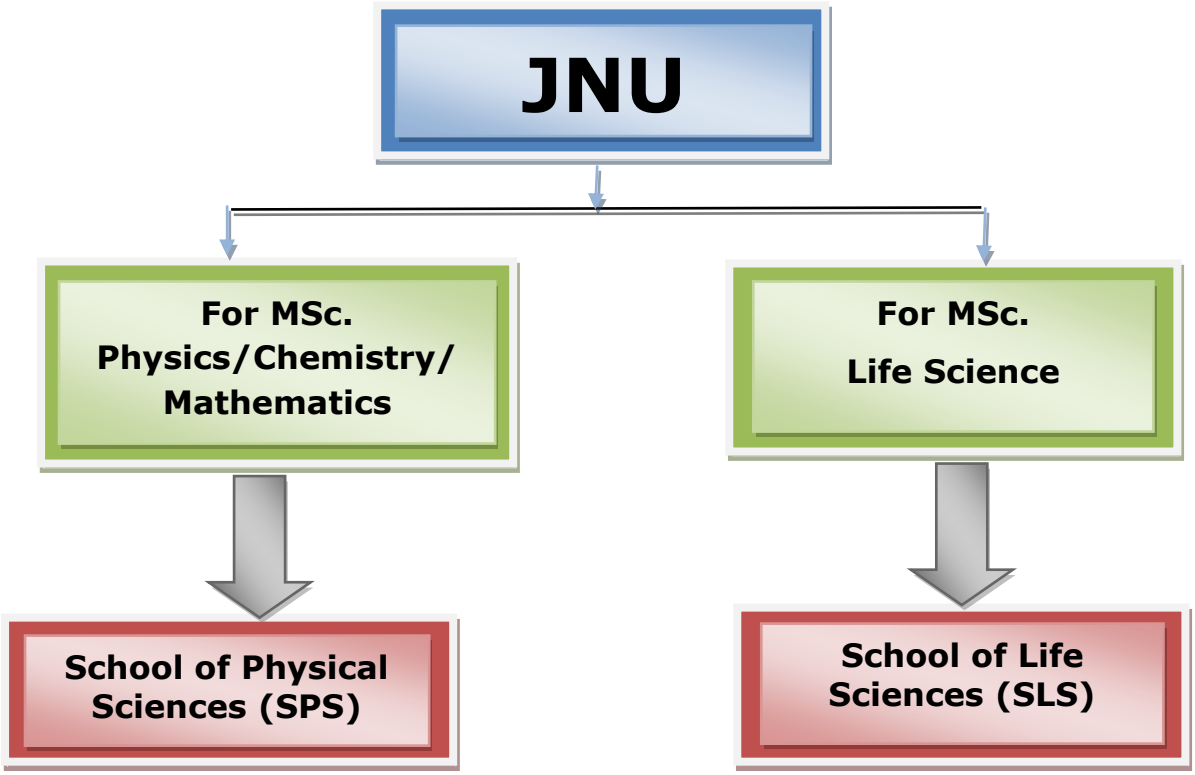
JNU

- The National Testing Agency (NTA) has been entrusted with the conduct of Jawaharlal Nehru University Entrance Examination (JNUEE) from 2019 onwards.
- Admission to JNU is based on the performance of candidates in the All India Level Entrance Examination.
- The final selection is based upon the performance of candidates in the CBT for all programmes of study, except M.Phil. and Ph.D.



ELIGIBILITY CRITERIA: -

- There is no age bar for below programmes.

SUBJECTS	AGGREGATE MARKS	QUALIFICATION
Physics	With 55% marks in the aggregate	▪ B.Sc./ Physics Honours degree under the 10+2+3 pattern with (*Physics, Chemistry and Mathematics combined*) ▪ B.Tech.(*Electronics/Electrical/Mechanical/Computer*)
Chemistry	With 55% marks in the aggregate	▪ B.Sc./ Chemistry Honours degree under the 10+2+3 pattern with (in *Chemistry, Physics and Mathematics combined*) ▪ B.Tech degree (*Chemical/Polymer/Petroleum Engineering)*
Mathematics	At least 55% marks or equivalent	▪ Bachelor's degree in *Mathematics* under the 10+2+3/4 system ▪ B.Tech or B.E. in any of the *Engineering* disciplines (with a CGPA of at least 6.0 out of 10.0).
Life Science	At least 55% marks	▪ B.Sc./B.Tech or equivalent (in *Biological, Physical or Agricultural Sciences or Biotechnology)* under the 10+2+3 pattern

EXAM PATTERN

PATTERN	FOR PH, CY, MA	FOR LS
Duration of the examination	3 hours	
Mode of Exam	CBT (Computer Based Test)	
Medium	English	
Number of Questions	**TOTAL 35 questions** Section A – 5 questions Section B – 30 questions	**TOTAL 100 questions** Part A – 30 questions (*All are compulsory*) Part B – 100 questions (*70 questions to be attempted out of 100*)
Types of Questions	Multiple choice questions	
Marks for correct Answer	Section A – 2 Marks each Section B – 3 Marks each	1 Mark each for correct answer
Marks for Incorrect Answer	No Negative marking	½ mark will be deducted for each wrong answer

NUMBER OF SEATS:

Department	Sub	Intake	Seat Matrix						
			UR	SC	ST	PWD	OBC	EWS	TOTAL
M.Sc. in Physics	SPSM	41	17	06	03	02	11	04	41
M.Sc. in Chemistry	CHEM	25	10	04	02	01	06	03	25
M.Sc. in Mathematics	MATM	15	06	02	01	01	04	02	15
M.Sc. in Life Sciences	SLSM	38	15	06	03	02	10	04	38

*(As per year 2020)

Syllabus:

SYLLABUS FOR MSc in PHYSICS

Mathematical Methods: Calculus of single and multiple real variables. Fourier and Laplace transforms. Vector Calculus, Divergence theorem, Green's theorem, Stokes' theorem. First order and linear second order differential equations with constant coefficients. Matrices and determinants. Complex numbers.

Mechanics and General Properties of Matter: Newton's laws of motion and applications. Motion under a central force, and Kepler's laws. Elastic and inelastic collisions. Rigid body motion. Principal moments and axes. Kinematics of fluids. Bernoulli's theorem.
Oscillations, Waves and Optics: Simple harmonic motion. Damped and forced oscillators. Resonance. Wave equation. Group and phase velocities. Sound waves in media. Doppler Effect. Interference and diffraction. Diffraction gratings. Polarization: linear, circular and elliptic polarization. Double refraction and optical rotation.

Electromagnetism: Coulomb's law. Gauss's law. Electric field and potential. Solution of Laplace's equation for simple cases. Conductors, capacitors, dielectrics. Electrostatic energy. Biot-Savart law, Ampere's law, Faraday's law of electromagnetic induction. LCR circuits. Maxwell's equations and plane electromagnetic waves, Poynting's theorem. Transmission and reflection coefficients (normal incidence only). Lorentz Force and motion of charged particles in electric and magnetic fields.

Thermal and Statistical Physics: Maxwell-Boltzmann distribution. Equipartition of energy. Ideal gas law. Specific heat. van-der-Waals gas and equation of state. Laws of thermodynamics. First law and its consequences. Isothermal and adiabatic processes. Second law and entropy. Maxwell's thermodynamic relations. Thermodynamic potentials. Fermi-Dirac and Bose-Einstein distributions.

Modern Physics: Basics of special relativity. Length contraction. Time dilation. Relativistic velocity addition theorem. Mass-energy equivalence. Blackbody radiation. Photoelectric effect. Compton effect. Bohr's atomic model. Pauli exclusion principle. Wave-particle duality. Uncertainty principle. Superposition principle. Schrödinger equation. Particle in a box problem in one, two and three dimensions. Solution of the Schrödinger equation for one dimensional harmonic
oscillator. Structure of atomic nucleus, mass and binding energy. Radioactivity.

Solid State Physics, Devices and Electronics: Crystal structure, Bravais lattices and basis. Miller indices. X-ray diffraction and Bragg's law. Intrinsic and extrinsic semiconductors, variation of resistivity with temperature. Fermi level. p-n junction diode, I-V characteristics, Zener diode and its applications. Transistor characteristics. R-C coupled amplifiers. Operational Amplifiers: Inverting and non-inverting amplifier. Boolean algebra: Binary number systems; binary addition and subtraction. Conversion from one number system to another.
Logic Gates AND, OR, NOT, NAND, NOR, X-OR. Truth tables. Combination of gates.

SYLLABUS FOR MSc in CHEMISTRY

PHYSICAL CHEMISTRY

Basic Mathematical Concepts: Functions; maxima and minima;
integrals; ordinary differential equations; vectors and matrices; determinants; elementary statistics and probability theory.

Atomic and Molecular Structure: Fundamental particles; Bohr's theory of hydrogen-like atom; wave-particle duality; uncertainty principle; Schrödinger's wave equation; quantum numbers; shapes of orbitals; Hund's rule and Pauli's exclusion principle; electronic configuration of simple homonuclear diatomic molecules.

Theory of Gases: Equation of state for ideal and non-ideal (van der Waals) gases; Kinetic theory of gases; Maxwell-Boltzmann distribution law; equipartition of energy.

Solid state: Crystals and crystal systems; X-rays; NaCl and KCl structures; close packing; atomic and ionic radii; radius ratio rules; lattice energy; Born-Haber cycle; isomorphism; heat capacity of solids.

Chemical Thermodynamics: Reversible and irreversible processes; first law and its application to ideal and nonideal gases; thermochemistry; second law; entropy and free energy; criteria for spontaneity.

Chemical and Phase Equilibria: Law of mass action; Kp, Kc, Kx and Kn; effect of temperature on K; ionic equilibria in solutions; pH and buffer solutions; hydrolysis; solubility product; phase equilibria–phase rule and its application to one-component and two-component systems; colligative properties.

Electrochemistry: Conductance and its applications; transport number; galvanic cells; EMF and free energy; concentration cells with and without transport; polarography; concentration cells with and without transport; Debey-Huckel-Onsagar theory of strong electrolytes.
Chemical Kinetics: Reactions of various order; Arrhenius equation; collision theory; transition state theory; chain reactions – normal and branched; enzyme kinetics; photochemical processes; catalysis.

Adsorption: Gibbs adsorption equation; adsorption isotherm; types of adsorption; surface area of adsorbents; surface films on liquids.

Spectroscopy: Beer-Lambert law; fundamental concepts of rotational, vibrational, electronic and magnetic resonance spectroscopy.

ORGANIC CHEMISTRY

Basic Concepts in Organic Chemistry and Stereochemistry: Electronic effects; resonance, inductive, hyperconjugation, aromaticity, tautomerism; organic acids and bases; optical

isomerism in compounds with and without any stereocenters (allenes, biphenyls); conformation of acyclic systems (substituted ethane/*n*-propane/*n*-butane) and cyclic systems (mono- and di-substituted cyclohexanes).

Organic Reaction Mechanism and Synthetic Applications:
Chemistry of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes, benzynes); Hofmann-Curtius-Lossen rearrangement, Wolff rearrangement, Simmons-Smith reaction, Reimer-Tiemann reaction, Michael reaction, Darzens reaction, Wittig reaction and McMurry reaction; Pinacol-pinacolone, Favorskii, benzilic acid rearrangement, dienone-phenol rearrangement, Baeyer-Villeger reaction; oxidation and reduction reactions in organic chemistry; organometallic reagents in organic synthesis (Grignard, organolithium and organocopper); Diels-Alder, electrocyclic and sigmatropic reactions; functional group inter-conversions and structural problems using chemical reactions.

Spectroscopic Analysis: Identification of functional groups by UV, IR and 1H NMR spectroscopic techniques as tools for structural elucidation.

Natural Products Chemistry: Chemistry of alkaloids, steroids, terpenes, carbohydrates, amino acids, peptides and nucleic acids.

Aromatic and Heterocyclic Chemistry: Monocyclic, bicyclic and tricyclic aromatic hydrocarbons, and monocyclic compounds with one hetero atom: synthesis, reactivity and properties.

INORGANIC CHEMISTRY

Periodic Table: Periodic classification of elements and periodicity in properties; general methods of isolation and purification of elements.
Chemical Bonding and Shapes of Compounds: Types of bonding; VSEPR theory and shapes of molecules; hybridization; dipole moment; ionic solids; structure of NaCl, CsCl, diamond and graphite; lattice energy.

Concepts of Acids and Bases: Bronsted and Lewis acids and bases; Gas phase versus solution phase acidity; solvent levelling effects; hardness and softness.

Oxidation and Reduction: Redox potentials; Nernst equation; influence of complex formation; precipitation; change of pH and concentration on redox potentials; analysis of redox cycles; redox stability in water; disproportionation/ comproportionation.

Main Group Elements (s and p blocks): General concepts on group relationships and gradation in properties; structure of electron deficient compounds involving main group elements.

Transition Metals (d block): Characteristics of 3d elements; oxide, hydroxide and salts of first row metals; coordination complexes: structure, isomerism, reaction mechanism and electronic spectra; VB, MO and Crystal Field theoretical approaches for structure, color and magnetic properties of metal complexes; organometallic compounds having ligands with back bonding capabilities such as metal carbonyls, carbenes, nitrosyls and metallocenes; homogenous catalysis.

***Bioinorganic Chemistry*:** Essentials and trace elements of life; basic reactions in the biological systems and the role of metal ions, especially Fe2+, Fe3+, Cu2+ and Zn2+; structure and function of hemoglobin and myoglobin and carbonic anhydrase.

Instrumental Methods of Analysis: Basic principles; instrumentations and simple applications of conductometry, potentiometry and UV-vis spectrophotometry.

Analytical Chemistry: Principles of qualitative and quantitative analysis; acid-base, oxidation-reduction and complexometric titrations
using EDTA; precipitation reactions; use of indicators; use of organic reagents in inorganic analysis.

SYLLABUS FOR MSc in MATHEMATICS

Set Theory and related topics: Elementary set theory, Finite, countable and uncountable sets, Equivalence relations and partitions

Real Numbers, Sequences and Series: Real number system as a complete ordered field, Archimedean property, supremum, infimum, Sequence of real numbers, convergence of sequences, bounded and monotone sequences, convergence criteria for sequences of real numbers, Cauchy sequences, subsequences, Bolzano-Weierstrass theorem. Series of real numbers, absolute convergence, tests of convergence for series of positive terms - comparison test, ratio test, root test, Leibniz test for convergence of alternating series.

Real Analysis: Interior points, limit points, open sets, closed sets, bounded sets, connected sets, compact sets. Power series (of a real variable), Taylor's series, radius and interval of convergence, term-wise differentiation and integration of power series.

Functions of One Real Variable: Limit, continuity, intermediate value property, differentiation, Rolle's Theorem, mean value theorem, L'Hospital rule, Taylor's theorem, maxima and minima.

Functions of Two and Three Real Variables: Limit, continuity, partial derivatives, differentiability, maxima and minima.

Integral Calculus: Integration as the inverse process of differentiation, definite integrals and their properties, fundamental theorem of calculus. Double and triple integrals, change of order of integration, calculating surface areas and volumes using double integrals, calculating volumes using triple integrals.

Vector Calculus: Scalar and vector fields, gradient, divergence, curl, line integrals, surface integrals, Green, Stokes and Gauss theorems.

Group Theory: Groups, subgroups, Abelian groups, non-Abelian groups, cyclic groups, permutation groups, normal subgroups, Lagrange's Theorem for finite groups, group homomorphism and basic concepts of quotient groups, Cayley's theorem, class equations.

Linear Algebra: Finite dimensional vector spaces, linear independence of vectors, basis, dimension, linear transformations, matrix representation, range space, null space, rank-nullity theorem. rank and inverse of a matrix, determinant, solutions of systems of linear equations, consistency conditions, eigenvalues and eigenvectors for matrices, Cayley-Hamilton theorem, Inner product spaces, Orthonormal basis

Miscellaneous: Logical reasoning, elementary combinatorics, divisibility in Integers, Congruence, Chinese remainder theorem, Euler's φ-function

SYLLABUS FOR MSc in LIFE SCIENCES

1. Candidates will be tested in their basic knowledge in the core subjects of Life/ Biological Sciences.

2. The test would contain subject-specific questions encompassing different branches of Life/Biological Sciences taught at the under graduate level in various UGC affiliated colleges /institutions in the country.

3. There is no specific syllabus designed for the test, but the candidates are advised to follow the UGC approved syllabus in their respective subjects for guidance.