CUCET Physics (M.Sc Entrance)

THE CUCET-2019 Examination: A consortium of 14 Central Universities of Andhra Pradesh, Assam, Gujarat, Haryana, Jammu, Jharkhand, Karnataka, Kashmir, Kerala, Mahatma Gandhi (Bihar), Rajasthan, Tamil Nadu, Punjab and South Bihar established by an Act of Parliament and the Bengaluru Dr. B.R. Ambedkar School of Economics (BASE) registered under the Karnataka Societies Registration Act, jointly organize a combined **CENTRAL UNIVERSITIES COMMON ENTRANCE TEST (CUCET - 2019)** for admission to their various programmes.

QUESTION PAPER PATTERN

All Question Papers will be MCQ based consisting of:

(i) Part A: English Language, general awareness, mathematical aptitude and analytical skills – comprising of 25 MCQs

(ii) Part B: Domain Knowledge – comprising of 75 MCQs. This part may consist of one/two/three or more sections. Each section can have 25 or more questions. An applicant is required to answer a set of 'X' sections (75 questions) as specified on the front cover of the Test Question Booklet. However, he/she must ensure that he/she fills right circles in the OMR Sheet corresponding to the question numbers attended.

(iii) For example, Part B of Entrance Test-Paper (e.g. UIQP01) shall consist of four sections i.e. Physics, Chemistry, Mathematics and Biology comprising 25 questions each. Applicants shall be required to attempt any three sections with combination of either PCM or PCB. While choosing the combination applicant must ensure that he/she has appeared in respective subjects at 10+2 or Pre-Board or equivalent qualifying exam.

(iv) If an Entrance Test-paper contents X number of sections and an applicant is required to answer Y number of section but if an applicant attempt all 'X' sections then best of 'X' sections as per instructions on the question booklet will be considered for preparation of Merit list.

(v) Admission to some Integrated Programmes/B.Voc/MBA/MCA/LLB or any other general Programme, only one paper comprising of 100 MCQs covering English language, reasoning, data interpretations/ numerical ability, general awareness and analytical skills will be held.

(vi) An applicant will have to choose one correct answer and mark on OMR Sheet. However if an applicant marks multiple entries in the OMR Sheet for particular question(s), it will be treated as wrong answer with negative marking.

(vii) Each paper will be only of Two Hours Duration.

(viii) **There will be negative marking in CUCET-2019 in UI and PG programmes.** Each correct answer will carry 01 mark and for each wrong answer, 0.25 marks will be deducted. Questions not attempted will not be assessed and hence will not be considered for preparing final merit list.

(ix) No negative marking for research programmes of CUCET examination 2019.

SYLLABUS

Mathematical Methods: Calculus of single and multiple variables, partial derivatives, Jacobian, imperfect and perfect differentials, Taylor expansion, Fourier series. Vector algebra, Vector Calculus, Multiple integrals, Divergence theorem, Green's theorem, Stokes' theorem. First order equations and linear second order differential equations with constant coefficients. Matrices and determinants, Algebra of complex numbers.

Mechanics and General Properties of Matter: Newton's laws of motion and applications, Velocity and acceleration in Cartesian, polar and cylindrical coordinate systems, uniformly rotating frame, centrifugal and Coriolis forces, Motion under a central force, Kepler's laws, Gravitational Law and field, Conservative and non-conservative forces. System of particles, Center of mass, equation of motion of the CM, conservation of linear and angular momentum, conservation of energy, variable mass systems. Elastic and inelastic collisions. Rigid body motion, fixed axis rotations, rotation and translation, moments of Inertia and products of Inertia, parallel and perpendicular axes theorem. Principal moments and axes. Kinematics of moving fluids, equation of continuity, Euler's equation, Bernoulli's theorem.

Oscillations, Waves and Optics: Differential equation for simple harmonic oscillator and its general solution. Superposition of two or more simple harmonic oscillators. Lissajous figures. Damped and forced oscillators, resonance. Wave equation, traveling and standing waves in one-dimension. Energy density and energy transmission in waves. Group velocity and phase velocity. Sound waves in media. Doppler Effect. Fermat's Principle. General theory of image

formation. Thick lens, thin lens and lens combinations. Interference of light, optical path retardation. Fraunhofer diffraction. Rayleigh criterion and resolving power. Diffraction gratings. Polarization: linear, circular and elliptic polarization. Double refraction and optical rotation.

Electricity and Magnetism: Coulomb's law, Gauss's law. Electric field and potential. Electrostatic boundary conditions, Solution of Laplace's equation for simple cases. Conductors, capacitors, dielectrics, dielectric polarization, volume and surface charges, electrostatic energy. Biot-Savart law, Ampere's law, Faraday's law of electromagnetic induction, Self and mutual inductance. Alternating currents. Simple DC and AC circuits with R, L and C components. Displacement current, Maxwell's equations and plane electromagnetic waves, Poynting's theorem, reflection and refraction at a dielectric interface, transmission and reflection coefficients (normal incidence only). Lorentz Force and motion of charged particles in electric and magnetic fields.

Kinetic theory, Thermodynamics: Elements of Kinetic theory of gases. Velocity distribution and Equipartition of energy. Specific heat of Mono-, di- and tri-atomic gases. Ideal gas, van-der-Waals gas and equation of state. Mean free path. Laws of thermodynamics. Zeroth law and concept of thermal equilibrium. First law and its consequences. Isothermal and adiabatic processes. Reversible, irreversible and quasi-static processes. Second law and entropy. Carnot cycle. Maxwell's thermodynamic relations and simple applications. Thermodynamic potentials and their applications. Phase transitions and Clausius-Clapeyron equation. Ideas of ensembles, Maxwell-Boltzmann, Fermi-Dirac and Bose Einstein distributions.

Modern Physics: Inertial frames and Galilean invariance. Postulates of special relativity. Lorentz transformations. Length contraction, time dilation. Relativistic velocity addition theorem, mass energy equivalence. Blackbody radiation, photoelectric effect, Compton effect, Bohr's atomic model, X-rays. Wave-particle duality, Uncertainty principle, the superposition principle, calculation of expectation values, Schrödinger equation and its solution for one, two and three dimensional boxes. Solution of Schrödinger equation for the one dimensional harmonic oscillator. Reflection and transmission at a step potential, Pauli exclusion prin-ciple. Structure of atomic nucleus, mass and binding energy. Radioactivity and its applications. Laws of radioactive decay.

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, BJT: characteristics in CB, CE, CC modes. Single stage amplifier, two stage R-C coupled amplifiers. Simple Oscillators: Barkhausen condition, sinusoidal oscillators. OPAMP and applications: Inverting and non-inverting amplifier. Boolean algebra: Binary number systems; conversion from one system to another system; binary addition and subtraction. Logic Gates AND, OR, NOT, NAND, NOR exclusive OR; Truth tables; combination of gates; de Morgan's theorem.