अंतर-विश्वविद्यालय त्वरक केंद्र
INTER-UNIVERSITY ACCELERATOR CENTRE
अरूणा आसफ अली मार्ग, नई दिल्ली – 110 067
Aruna Asaf Ali Marg, New Delhi-110067

वेबसाईट/**website: www.iuac.res.in**

पाठ्यक्रम समय-सारणी /**Course Schedule**

छमाही- I:Semester-I: अगस्त 2025 - दिसंबर 2025 /August 2025-December 2025

एडवांस्ड क्लासिकल एण्ड क्वांटम मैकेनिक्स, एक्सपेरिमेंटल फ़िज़िक्स, एक्सेलरेटर फ़िज़िक्स /

Advanced Classical & Quantum Mechanics, Experimental Physics, Accelerator Physics

	Period		Course Module	Lecturer
Inter-University Accelerator Centre (IUAC) conducts specialized lecture courses for Ph.D (Physics). Programme at the Centre. The programme is divided into three periods with each period having two/three course modules. Students doing Ph.D (Physics) and interested young faculty members from any University, College or Research Institute pursuing Ph.D (Physics) Degree may attend the lectures for the modules of their interest. The minimum qualification required to attend the course work is M.Sc.(Physics). Some financial assistance towards travel and accommodation will be available for a Limited number of cases. Those who have registered for Ph.D. on or after 1st July 2023 may apply with their biodata, research interest and a recommendation letter (which is compulsory) from their Ph.D Guide/Supervisor. The Registration will open from 1st July 2025. For Registration, please scan the code or click the link: https://gate.iuac.res.in/iuac_forms/index.php/web_panel/home/iuac_course_module **For any query:** E-Mail: academic@iuac.res.in/ programphdteaching@gmail.com	1. 11th Aug–20th Sept., 2025	611A	Advanced Classical Mechanics	Prof. Amit Rai, JNU
		626B	Accelerators and their Applications	Dr. Ambuj Tripathi, IUAC
		617C	Vacuum Techniques	Dr. Soumen Kar, IUAC
		617B	Signal Processing	Dr.Akhil Jhingan, IUAC
	2. 22nd Sept – 31st Oct, 2025	617A	Detectors & Transducers	Dr P. Sugathan, IUAC
		626A	Ion Sources	Mr. Sunil Ojha, IUAC
		617D	Data Acquisition System	Er. E.T. Subramaniam/ Ms. Mamta Jain, IUAC
	3. 1st Nov- 12th Dec, 2025	611B	Advanced Quantum Mechanics	Prof. Ajit Mohan Srivastava, IOP
		626D	Cryogenics and Superconductivity	Dr. Anup Choudhury, IUAC
		617E	Engineering Drawing	Er.Thomas Varughese IUAC / Er. Rajeev Ahuja
		626C	Beam Optics and Beam Transport	Dr. N. Madhavan, IUAC

611 ADVANCEDCLASSICAL&QUANTUMMECHANICS

611A ADVANCED CLASSICAL MECHANICS: Particle motion in 1, 2 & 3 dimensions; conservation laws; non-inertial frames, Generalized coordinates; Lagrangian methods and examples; two body problem; bound states and scattering, Small oscillations; Hamiltonian formalism; canonical transformations; Hamilton-Jacobi theory, Special relativity and relativistic kinematics.

611BADVANCEDQUANTUMMECHANICS: One-dimensional Schrödinger equation; particle in a square well potential; bound states; transmission and reflection from step potentials; W.K.B. method for bound states; tunnelling, harmonic oscillator; operator method of solution. Two-level and other finite-dimensional Hilbert space problems. Three dimensional Schrödinger equation, angular momentum, algebra of angular momentum; square well in 3 dimensions; hydrogen atom. Perturbation theory. Atoms in electric magnetic fields; spin-orbit coupling; scattering theory, General Symmetries in nuclei with special reference to isospin and parity.

617 EXPERIMENTALPHYSICS

617A DETECTORS & TRANSDUCERS: Energy loss of charged particles in matter; range & straggling, energy, position & time detection for charged particles with solid state detectors, gas detectors - ionization chamber, multi-wire proportional counter; Interaction of radiation with matter; semi-conductor gamma detector, scintillation detectors, channel electron multipliers and micro-channel plates. Particle identification techniques & time of flight.

617B SIGNAL PROCESSING: Transmission lines, impedance matching; Noise, filters, pre-amplifiers, amplifiers, pole-zero cancellation, Base line restoration, Pile up rejection, introduction to NIM Standards. Timing measurement, Leading edge and constant fraction discriminators, coincidence measurements, gates, Time-amplitude converter, analog-digital conversion.

617C VACUUM TECHNIQUES: Basic elements of vacuum science, viscous and molecular flow, conductance, pumping speed etc. Displacement & containment pumps, Design of ultra high vacuum system, vacuum measurement system, vacuum measurement gauges, Control & interlock system, Leak detection techniques.

617D DATA ACQUISITION SYSTEM: Data collection using CAMAC and VME; Hardware conditions and configurations; Event mode data collection and multi dimensional histograms; Software conditions; Analysis of experimental data and extraction of physics results; Available open source software.

617E ENGINEERING DRAWING: Projections, Sectional drawing, Representation of fasteners, Tolerance, Welding & drawing. Practical demonstration of fabricating a vacuum component.

626 ACCELERATORPHYSICS

626A ION SOURCES: Production of charged particles, space charge limitation; extraction & focusing geometries, positive and negative ion sources, radio frequency sources, penning ionization source, Duo plasmatron, sputter ion source, ECR source (room temperature and superconducting).

626B ACCELERATORS & THEIR APPLICATIONS: Electrostatic accelerators - Cockroft-Walton, Van-de-Graaff, Principle of tandem accelerator, Pelletron accelerator; Pulsed accelerators cyclotron, synchrotron; Radio frequency linear accelerators; Superconducting linac, Radio frequency quadrupole; Drift tube linac; Storage rings; Future trends. Trace element analysis: various methods, RBS - measurement of elemental ratios & concentrations, channelling RBS, ERDA - depth resolution &sensitivity, high resolution sub monolayer thickness studies, Nuclear Reaction Analysis (NRA), Particle Induced X ray emission (PIXE) studies, Accelerator Mass Spectrometry (AMS), Medical applications of accelerators.

626C BEAM OPTICS AND BEAM TRANSPORT: Motion of charged particles in electric and magnetic fields; Phase space longitudinal and transverse, and Liouville's theorem, Focusing devices: Einzel lens, solenoid magnet, quadrupole; magnetic and electric sector fields; Matrix method, Aberrations, Design of a beam line for beam transport Computer simulations.

626D CRYOGENICS & SUPERCONDUCTIVITY: Introduction to cryogenics and its application to accelerators, achieving low temperature, liquefaction of gases; Basic thermo dynamic processes, various thermo dynamic cycles, commercial liquifiers /refrigeration, critical components. Heat transfer at low temperature: conduction, convection, radiation processes, insulation, LN2 / LHe storage vessels, cryostat design - properties of materials at low temperature, heat load calculation; Basic superconductivity, superconducting magnet; Cryogenic instrumentation - temperature sensor, liquid helium / nitrogen level, flow sensors.