

## DEPARTMENT OF PHYSICS

### TEACHING FACULTY

#### Professor

Mahmood Mian, Ph.D. AMU  
Bikramjit Singh Bajwa, Ph.D. GNDU  
Lakhwant Singh, Ph.D. GNDU  
Sham Sunder Malik, Ph.D. PU  
Nareshpal Singh Saini, (Head) Ph.D. GNDU  
Davinder Paul Singh, Ph.D. GNDU  
Atul Khanna, Ph.D. GNDU  
Kanwarjit Singh, Ph.D. GNDU  
Ravi Chand Singh, Ph.D. GNDU (Re-employed)

#### Assistant Professor

Aman Mahajan, Ph.D. GNDU  
Bindiya Arora, Ph.D. Delaware University, USA  
Sukhdeep Kaur, Ph.D. IIT Delhi  
Anupinder Singh, Ph.D. IIT Delhi  
Sandeep Sharma, Ph.D. University of Groningen,  
Netherlands  
Harjeet Kaur, Ph.D. GNDU  
Paramjit Kaur, Ph.D. IIT Roorkee  
Mandeep Singh, Ph.D. IIT Delhi

#### Associate Professor

Jaspal Singh, Ph.D. GNDU, Amritsar

#### Courses offered

- B.Sc. (Hons. School)
- M.Sc. (Hons. School)
- M.Sc.
- Ph.D.

#### Course Detail : B.Sc. (Hons. School)

#### Distribution of seats

Course Name	Duration (Years)	System	Total Seats	Reserved Categories			
				SC/ST	BC	RA	Others
B.Sc. (Hons. School)	3	Semester	75	19	4	5	10

#### Eligibility

- Senior Secondary Examination (12<sup>th</sup> grade) in any science subject with at least 50% marks (45% for SC/ST) in aggregate.
- Any other examination recognized equivalent thereto.

#### Mode of Admission

Admission will be based on merit of the candidate in qualifying examination. The Coordinator of admission shall be Dr. Kamaljit Singh, Prof., Department of Chemistry.

## Dates

a)	Fee deposit date in State Bank of India (Any Branch)	02.06.2017 to 20.06.2017
b)	Last Date for Online application Form submission	05.06.2017 to 23.06.2017
c)	Admission Counseling	06.07.2017 to 09.07.2017

**Venue :** Guru Nanak Bhavan, GNDU, Amritsar

## Contact No. :

**Coordinator/Head(M)** 99140-06662 Extn. 2258802-09 (3508)

**Fee(Approximate) :** Rs. 20360/- (1<sup>st</sup>.Sem.) Rs.4800/- (2<sup>nd</sup> Sem.)

## Course Detail : M.Sc. (Hons. School)

### Distribution of seats

Course	Duration (Year)	System	Total Seats	Reserved Category			
				SC/ST	BC	RA	Others
M.Sc. (Hons. School)	2	Semester	75	19	4	5	10

## Eligibility

Bachelor of Science (Hons. School) in Physics in Guru Nanak Dev University with a CGPA of 5.62 (5.06 CGPA for SC/ST) in aggregate.

## Mode of Admission

Admission will be based on merit of the candidate in B.Sc. (Hons. School)

## Dates

**Consult Head of the Department.**

## Contact No.

Coordinator/Head : 0183-2258802 —09, 2450601 —14, Ext. 3346

**Fee (Approximate):**Rs. 24060/- (Ist. Sem.)/ Rs. 8500/- (2nd Sem.)

**Course Detail : M.Sc.**

**Distribution of seats**

Course	Duration (Year)	System	Total Seats	Reserved Category			
				SC/ST	BC	RA	Others
M.Sc.	2	Semester	60	15	3	4	8

**Eligibility**

- Bachelor of Science with Physics, Mathematics & Chemistry/Electronics/Computer Science/Computer Application with at least 50% marks (45% for SC/ST) in aggregate.
- Any other examination recognized equivalent thereto.

**Mode of Admission**

Admission will be based on merit of the candidate in the Entrance Test to be conducted by the Department.

**Dates**

a)	Fee deposit date in State Bank of India (Any Branch)	05.06.2017 to 27.06.2017
b)	Last Date for Online application Form submission	07.06.2017 to 30.06.2017
c)	Entrance Test	12.07.2017 (02.00 p.m. - 03.30 p.m.)
d)	Admission Counseling	14.07.2017

**Venue :** New Lecture Theatre Block, GNDU Amritsar

**Contact No.**

Coordinator/Head 0183-2258802-09, 2450601-14 Ext. 3346

**Fee (Approximate)** Rs. 24060/- (1<sup>st</sup>.Sem.) Rs.8500/- (2<sup>nd</sup> Sem.)

**Special Features**

High standard experimental research facilities for quality research work leading to Ph.D. degree program have been established in the department as well as in university. The sophisticated research equipments such as FE-SEM, HRTEM, AFM, X-Ray Diffractometers with thin film attachment, Raman Spectrometer, UV-visible Spectrophotometer, Fluorescence Spectrophotometer, Source Meters, Impedance Analyzer, Ultrasonic Velocity and Attenuation Set-Up, Gas Sensors Test Facility, Ball Milling, RF Sputtering System, Vacuum Coating Units, Spin Coaters etc. and well maintained Computer Lab. are available.

Research work by different groups is focused on the areas of Material Science, Nuclear Geo-Physics based Seismotectonic studies, Environmental Radioactivity, Nuclear Physics, Plasma Physics, Atomic Physics and Quantum Computation. The research in material sciences has been carried out in thin films, oxide and chalcogenide glasses, amorphous materials, glasses and glass ceramics, radiation effects in glasses, gas sensors and ferromagnetic semiconductors. The Department has received huge amount of grants from the DST under the FIST-programme, UGC under the SAP (DRS-II) programme and is also through various running research projects in different fields sanctioned by various scientific organizations viz. DST, CSIR, IUAC, UGC and BRNS etc.

After completion of graduation and post graduation courses, the students are generally placed in different Educational Institutes, Research establishments (such as BARC, TIFR, DRDO, PRL, IPR etc.), Defence and IT Companies. M.Sc students have also been admitted to different institute in abroad for Ph.D. program.

## **Syllabus for Entrance Test for M.Sc Physics**

**Note:** - There will 50 multiple choice questions of two marks each. There will be no negative marking.

Basic ideas of Vector Calculus, Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical and spherical coordinates. Coulomb's Law for point charges and continuous distribution of charges. Electric field due to dipole, line charge and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.

Work and potential difference. Potential difference as line integral of field. Electric potential due to a point charge a group of point charges, dipole and quadrupole moments, long uniformly charged wire, charged disc. Stoke's theorem and its applications in Electrostatic field,  $\text{curl } E=0$ . Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments.

Physical interpretation of Maxwell's equations, E.M. waves and wave equation in a medium having finite permeability and permitivity but with conductivity. Poynting vector, Impedance of a dielectric to EM waves. EM waves in a conducting medium and Skin depth. EM wave velocity in a conductor and anomalous dispersion. Response of a conducting medium to EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence.

Postulates of special theory of relatively. Lorentz transformations, observer and viewer in relativity. Relativity of simultaneity, Length, Time, velocities. Relativistic Doppler effect. Variation

of mass with velocity, mass-energy equivalence, rest mass in an inelastic collision, relativistic momentum & energy, their transformation, concepts of Minkowski space, four vector formulation.

Simple harmonic motion, energy of a SHO. Compound pendulum. Torsional pendulum Electrical Oscillations Transverse Vibrations of a mass on string, composition of two perpendicular SHM of same period and of period in ratio 1:2.

Brief introduction to need and development of quantum mechanics, photoelectric effect, Compton effect, Wave particle duality, de Broglie hypothesis, Uncertainty principle, Gaussian wave packet. Operator correspondence. Normalization and probability interpretation of wave function. Superposition principle.

Expectation value, Probability current and conservation of probability. Admissibility conditions or wave function. Ehrenfest theorem, Eigen function and eigen value. Operator formalism, orthogonal system, expansion in eigen functions, Hermitian operator, simultaneous eigen function, equation of motion.

Fundamental postulates of wave mechanics, Schrodinger equation for a free particle and equation of a particle subject to forces. Schrodinger equation, Application to stationary states for one dimension, Potential Barrier, rectangular potential well, degeneracy, Orthogonality, Linear harmonic oscillator. Schrodinger equation for spherically symmetric potential for hydrogen atom. Spherical harmonics and their solution. Physical significance of quantum number. Degeneracy.

Concepts of current and voltage sources, p-n junction, Biasing of diode, V-I characteristics, Zener diode, Rectification: half wave, full wave rectifiers and bridge rectifiers, Efficiency, Ripple factor, Qualitative ideas of filter circuits (LC and  $\pi$  filters), Photonic devices (solar cell, photodiode and LED).

Junction transistor : Structure and working relation between different currents in transistors, Sign conventions, Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics, Structure and characteristics of JFET, Transistor biasing and stabilization of operating point, Voltage divider biasing circuit.

Constituents of nucleus, non-existence of electrons in nucleus, Nuclear mass and binding energy, features of binding energy versus mass number curve, nuclear radius, angular momentum and parity, qualitative discussion of two-body nuclear forces, nuclear moments, magnetic dipole moment and electric quadrupole moment.

Modes of decay of radioactive nuclides and decay Laws, chart of nuclides and domain of instabilities, radioactive dating, constituents of Cosmic rays, Beta decays:  $\beta^-$ ,  $\beta^+$  and electron capture decays, allowed and forbidden transitions (selection rules), parity violation in  $\beta$  decay, Alpha decay : Stability of heavy nuclei against beak up, Geiger-Nuttal law, barrier penetration as applied to alpha decay, reduced widths, deducing nuclear energy levels, Gamma transitions : Excited levels, isomeric levels, Gamma transitions.

Energy loss of electrons and positrons, Positrons annihilation in condensed media, Stopping power and range of heavier charged, derivation of Bethe-Bloch formula, interaction of gamma rays with matter.

Historical introduction, fermions and bosons, particles and antiparticles, Classification of particles, types of interactions, electromagnetic, weak, strong interactions, gravitational

interactions, Quantum numbers and conservation laws, isospin, charge conjugation, Yukawa theory, Introduction to quarks and qualitative discussion of the model, high energy physics units.

Crystal structure, Symmetry operations for a two dimensional crystal, Two dimensional Bravais lattices, Three dimensional Bravais lattices, Basic primitive cells, Crystal planes and Miller indices, Diamond and NaCl structure.

Crystal diffraction : Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Bragg's law in reciprocal lattice, Brillouin zones and its derivation in two dimensions, Structure factor and atomic form factor.

Band theory : Kronig-Penney model, Metals and insulators, Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Qualitative discussion of band gap in semiconductors, Superconductivity, Magnetic field effect in superconductors, BCS theory, Thermal properties of superconductors.

Phase space and its division into elementary cells. Three kinds of statistics. The basic approach in the three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of Maxwell Boltzman law of distribution of molecular speeds. Need for quantum statistics-Bose-Einstein (B.E.) statistics. Derivation of Planck's law of radiation. Deduction of Wien displacement law and Stefan's law from Planck's law, Fermi-Dirac (F.D.) statistics, Comparison of M.B., B.E. and F.D. statistics.

Statistical definition of entropy, Change of entropy of a system, Additive nature of entropy, Law of increase of entropy. Reversible and irreversible process and their examples. Work done in a reversible process, Examples of increase of entropy in natural processes, Entropy and disorder. Brief review of terms and laws of thermodynamics. Carnot's cycle, Entropy changes in Carnot cycle. Applications of thermodynamics to thermoelectric effect. Change of entropy along a reversible path in a P.V. diagram. Entropy of a perfect gas. Equation of state of an ideal gas from simple statistical consideration, Heat death of the universe.