

**SARDAR PATEL UNIVERSITY**  
**Programme & Subject: M.Sc (Physics)**  
**Semester: III**  
**Syllabus with Effect from: June - 2014**

<b>Paper Code: PS03EPHY05</b>	<b>Total Credit: 4</b>
<b>Title Of Paper: Theoretical Physics - I</b>	

Unit	Description in detail	Weightage (%)
I	Principle of equivalence – Principle of general covariance, metric tensor Riemann tensor – Ricci tensor, Einstein’s field equations: Newtonian limit – Equations of motion – Gravitational waves – centrally symmetric gravitational fields. Motion of Schwarzschild metric – circular orbits – Gravitational capture of particles – Motion of planets – Deflection of light – Schwarzschild radius. Relativistic equation of stellar structures – Newtonian stars with polytropic equations of state – White-dwarfs and neutron stars.	25%
II	Introduction to lattice dynamics, Wave propagation in lattices, Longitudinal vibrations, Transverse vibrations, consideration for a finite lattice. Fixed end point boundary condition, Frequency distribution function Periodic boundary condition Time development of lattice vibrational states Vibrational modes with a basis Enumeration of modes Excitation of the optical branch and infrared absorption in ionic crystals. Normal modes and their quantizations, Distribution of energy among the normal modes.	25%
III	Dispersion relation and quantization of lattice vibrations, equations of motion, central forces, Angular forces, Secular determinant for a face centered cubic lattice, Covalent, molecular and metallic crystals, Quantization of lattice, vibrations. Normal co-ordinates of a lattice phenomenological theory of lattice dynamics thermal properties of micro crystallites.	25%
IV	Atomic & Molecular Physics – Resume of partial waves and calculation of scattering phase shifts. Absorption processes and scattering by complex potential. Electron-Hydrogen scattering in the 1 <sup>st</sup> order calculations Ground state and the potential energy curves of H <sub>2</sub> molecule electronic structure of H <sub>2</sub> O, CO <sub>2</sub> , CH <sub>4</sub> , and C <sub>6</sub> H <sub>6</sub> molecules. Fullerenes (Introductory).	25%

**Basic Text & Reference Books:-**

- An introduction to General Relativity By S. K. Bose, Wiley Eastern Ltd. 1985
- Introduction to Cosmology, J. V. Narlikar, Cambridge University Press, Cambridge, 1993
- An Introduction Lattice Dynamics, A. K. Ghatak and L. S. Kothari Addison-Wesley Publishing Company (London)
- Quantum theory of the Solid State, by Joseph Callaway
- Quantum Collision theory, C. J. Joachain (North Holland)
- Physics of Atoms & Molecules, B. Bransden & C. J. Joachain (Longman)

