

SARDAR PATEL UNIVERSITY
Programme & Subject: M.Sc (Physical Chemistry)
Semester: III
Syllabus with Effect from: June - 2013

Paper Code: PS03CPHC02	Total Credit: 4
Title Of Paper: Nuclear Chemistry	

Unit	Description in detail	Weightage (%)
I	<p>Radioactive Decay: Half life, Mean life, Decay constant, Types of Radioactive decay, General characteristics of radio active decay: (i) Mass loss & Energy release and (ii) Nuclear radiations.</p> <p>Nuclear Reactions : Bathe's notation, Types of nuclear reactions: Elastic Scattering, Photonuclear reaction, Radiative capture, Special nuclear reactions, Evaporation, Fragmentation, Transfer reactions</p>	25%
II	<p>Nuclear Fission: Nuclear shape distortion following excitation, Relation between fission Energy & Fission barrier, Fission parameter.</p> <p>Fission Yield: Fission Energy, Spontaneous Fission, Fission by high Energy neutrons, Fission Induced by Charged particles, Photo fission.</p> <p>Nuclear Fusion: Fusion reactions, Basic requirement for controlled thermo nuclear reaction, Threshold conditions, Lawson's criterion, Magnetic confinement (Pinch effect), and Inertial confinement.</p> <p>Q value: Q values & Reactions thresholds, Barrier for charged particles.</p> <p>Reaction Cross section: Units of Cross section, Cross section & Reaction rate, The 1/V Law (Variation of Neutron Capture Cross section with energy),</p>	25%
III	<p>Radioactive Equilibria: General equation, Transient Equilibria, Secular Equilibrium. The case of no equilibrium, A series of successive decays, Branching decay, Units of radioactivity.</p> <p>Tracers Techniques: Reaction mechanism, Structure determination, Isotope exchange reaction, Isotope dilution analysis: (i) Direct Isotope dilution analysis (DIDA) (ii) Inverse Isotope Dilution Analysis (IIDA) and (iii) Sub stoichiometric isotope dilution Analysis, Dating by Tritium Content, Dating by ¹⁴C, Medical applications, Agriculture applications, Industrial applications</p>	25%
IV	<p>Neutron Activation Analysis: Principle, Prompt, τ Neutron activation analysis.</p> <p>Counting Techniques: Electron multiplication in a gas, The gas counter (Ionization Counter), The Geiger - Muller Counter: (i) Thin end Window Counter; (ii) Thin liquid counter, Proportional Counter.</p>	25%



Nuclear Reactors : Fission energy, Natural uranium reactor, Four factor formula, classification of reactors, reactor power, the Breeder Reactor, reprocessing of Spent Fuel and nuclear waste management	
---	--

Basic Text & Reference Books:-

- Essentials of Nuclear Chemistry, H. J. Arnikar, Wiley Eastern Limited, New Delhi
- Elements of Nuclear Chemistry, R. Gopalan, Vikas Publishing House Pvt.Ltd.
- Nuclear Chemistry, Bernard G. Harvey, Prentice - Hall, Inc., Englewood Cliffs, N.J.

