| Phys 4304 | NUCLEAR PHYSICS-II | (CR3) |
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| Preq. | Phys 4303/ ADP (Physics) | |

**Objectives**

*This part deals with some additional topics of nuclear physics.*

**Syllabus**

Nuclear Reactions, types of nuclear reactions and conservation laws, Coulomb scattering, nuclear scattering, Q-value of nuclear reaction, threshold energy, transmutation by photons, protons, deutrons and alpha particles, Cross section from nuclear reactions, compound nucleus theory of nuclear reactions, limitations of compound nucleus theory, direct reactions, Neutron Physics, Neutron sources, radioactive sources, photon neutron sources, charged particle sources, reactor as a neutron source, slowing down of neutron, neutron detectors, neutron capture, interference and diffraction with neutrons, Nuclear fission, Description of fission reaction, Mass distribution of fission fragments, Average number of neutrons released, Fission cross section, Chain reaction, Controlled fission reactions, Fission reactors. Nulclear Fusion, Basic fusion processes, Energy released in nuclear fusion, Solar fusion, p-p cycle, CNO cycle, controlled nuclear fusion, D-D and D-T reactions, accelerators, electrostatic accelerators, cyclotrons, synchrotrons, linear accelerators, colliding-beam accelerators.

***Recommended Books***

1. *Introductory Nuclear Physics by K. Krane, Wiley (1980)*
2. *Nuclear and Particle Physics by Burcham, E. E. and Jobes, M., Longman (1995)*
3. *Nuclear and Particle Physics by Martin, R. B., John Wiley (2006)*
4. *Nuclear Physics by I. Kaplan, Addison-Wesley (1980).*
5. *Nuclear Physics in a nutshell, by C.A. Bertulani, Princeton, (2007).*
6. *Nuclear Physics by A. Kamal, Springer, (2014)*
7. *Foundations of Nuclear and Particle Physics, T. W, Donnelly and J. A. Formaggio, Cambridge (2017)*
8. *Nuclear Physics: Principles and Applications by J. Lilley, John Wiley (2013)*

| **Phys 4102** | **RELATIVITY AND COSMOLOGY** | **(CR3)** |
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| **Preq.** | **Phys 3503/ ADP (Physics)** | |

**Objectives**

*The purpose of this course is to introduce the field of general relativity and cosmology.*

**Syllabus**

Einstein's postulates of special relativity, Lorentz transformations, structure of spacetime, Minkowski spacetime tensors, the light-cone, line element, four-vectors, relativity of simultaneity, velocity transformation and velocity addition. Force equation in relativity, rest mass, kinetic and total energy, conservation of energy and momentum. Covariant form of Maxwell's equations, four vector potential and field strength tensor. Elements of Tesnsor Calculus, Manifolds and coordinates, curves and surfaces, tensor fields, geodesics, Riemann tensor, Bianchi identity, metric tensor, Ricci tensor, Einstein's tensor. General Relativity, Principles of general relativity, weak and strong equivalence principle, equation of geodesics deviation, Einstein's field equations, tests of general theory of relativity, Cosmology, Newtonian cosmology, cosmological redshift, luminosity and redshift relation, Hubble's law, microwave background, the Big Bang, Friedmann models and cosmological constant, FRW metric.

***Recommended Books***

1. *Dynamics and Relativity by W. D. McComb, Oxford (1999)*
2. *Introduction to Cosmology by J. V. Narlikar, Cambridge (2002).*
3. *Introduction to Cosmology by B. Narlikar, Cambridge (2016).*
4. *Special Relativity: For the Enthusiastic, CreateSpace, (2017).*
5. *Introduction to General Relativity,C. Bambi, Springer, (2018)*
6. *Introducing Einstein's Relativity, by R. D'Inverno, Oxford (1992).*