

## Nuclear and Particle Physics

<b>1. Basic Nuclear Properties.....</b>	<b>(1-24)</b>
1.1 Rutherford Scattering Experiment and Distance of Closest Approach	
1.2 Nuclear Probes	
1.3 Size and Density	
1.4 Spin and Magnetic Moment	
1.5 Angular Momentum of Nucleus	
1.6 Stable Nuclei	
1.7 Binding Energy	
1.8 Electric Quadrupole Moment	
1.9 Isospin	
1.10 Statistics	
1.11 Parity	
<b>2. Nuclear Models.....</b>	<b>(25-41)</b>
2.1 Liquid Drop Model of Nucleus	
2.1.1 Most stable nuclei among members of Isobaric family	
2.1.2 Mass Parabola's	
2.1.3 $\beta$ -decay stability	
2.2 Shell Model of Nucleus	
2.2.1 Prediction of angular momentum and nuclear ground state	
2.2.2 Quadrupole Moment of Nuclei	
2.2.3 Magnetic Moment of Nuclei	
2.2.4 Failures of Nuclear Shell Model	
2.2.5 Excited States	
2.2.6 Existence of $2^+$ state as first excited states in Even-even nuclei.	
<b>3. Nuclear Forces.....</b>	<b>(42-45)</b>
3.1 Meson Theory of Nuclear Forces (Yukawa Theory)	
3.1.1 Postulates	

3.1.2 Yukawa Potential	
3.1.3 Salient Features of Nuclear Forces	
3.2 Deuteron Problem	
3.2.1 Properties	
3.2.2 Ground state of deuteron	
<b>4. Radio Active Decay.....</b>	<b>(46-64)</b>
4.1 Activity	
4.1.1 Half life time	
4.1.2 Mean life time	
4.1.3 Successive Growth	
4.2 Alpha Decay	
4.2.1 Tunnel Theory of $\alpha$ -decay	
4.3 Beta Decay	
4.3.1 Positron emission	
4.3.2 Electron capture	
4.4 Gamma Decay	
4.4.1 Various processes by which $\gamma$ -rays can lose its energy	
4.4.2 Internal Conversion	
4.4.3 Pair Production (Energy into matter)	
4.4.4 Pair Annihilation	
4.4.5 Massbauer Effect	
4.4.6 Gamma Decay Transition Rules	
<b>5. Nuclear Reaction.....</b>	<b>(65-77)</b>
5.1 Conservation Laws	
5.2 Nuclear Reaction Kinematics ( $Q$ – Value)	

5.2.1 General solution of  $Q$ -Equation

5.2.2 Exothermic Reaction ( $Q > 0$ )

5.2.3 Endothermic Reaction ( $Q < 0$ )

5.3 Nuclear Fission

5.4 Nuclear Fusion in Stars

**6. Particle Physics..... (78-90)**

6.1 Classification of Elementary Particles

6.1.1 Leptons

6.1.2 Baryons

6.1.3 Mesons

6.2 Particles and Anti-Particles

6.3 Elementary Particles Quantum Numbers

6.4 Classification of Fundamental Forces

6.5 Gellmann & Neeman's classification system for Hadrons

6.6 Quark Model of Hadrons

**Practice Set Questions..... (91-107)**

**Practice Set Solutions..... (108-122)**