

Contents

1 Introduction	
1.1 Fundamentals of Nuclear Reactor Physics	1
1.2 Reactor Materials	3
1.3 Neutron Interactions	6
1.4 Requirement of Nuclear Data	7
1.5 Objectives of present thesis	10
References	11
2 Experimental Methodology	
2.1 Particle Accelerators and Applications	17
2.2 Neutron Sources	18
2.3 Neutron Irradiation Facility	20
2.3.1 Folded Tandem Ion Accelerator (FOTIA)	20
2.3.2 14UD Pelletron Accelerator	21
2.4 Activation Analysis	22
2.4.1 γ -ray Spectroscopy	23
2.4.2 High Purity Germanium (HPGe) Detector	23
2.4.3 Energy Resolution	25
2.4.4 Efficiency Calibration	26
2.4.5 Background Radiation	28
References	30
3 Theoretical Calculations	
3.1 Introduction	32
3.2 TALYS code	32
3.3 EMPIRE code	35
References	40
4 Neutron capture cross section measurement for tungsten isotope in the neutron energy range 0.6 to 3.2 MeV	
4.1 Introduction	42
4.2 Experimental Details	42
4.3 Data Analysis	45
4.3.1 Measurement of γ -ray activity	45
4.3.2 Estimation of $^{186}\text{W}(n,\gamma)^{187}\text{W}$ reaction cross sections	51
4.4 Theoretical Calculations	56
4.5 Results and Discussion	57

4.6 Conclusion	59
References	60
5 Neutron induced reaction cross section measurement for zirconium (Zr), niobium (Nb), strontium (Sr) and rubidium (Rb) isotopes up to the energy of 20 MeV	
5.1 Introduction	63
5.2 Experimental Details	64
5.3 Cross section of $^{90}\text{Zr}(n,2n)^{89}\text{Zr}$ and $^{90}\text{Zr}(n,p)^{90\text{m}}\text{Y}$ reactions	67
5.3.1 Data Analysis	68
5.3.2 Theoretical Calculations	84
5.3.3 Results and Discussion	85
5.4 Cross section of $^{93}\text{Nb}(n,2n)^{94\text{m}}\text{Nb}$ and $^{88}\text{Sr}(n,2n)^{87\text{m}}\text{Sr}$ reactions	91
5.4.1 Data Analysis	91
5.4.2 Theoretical Calculations	98
5.4.3 Results and Discussion	99
5.5 Cross section of $^{85}\text{Rb}(n,p)^{85\text{m}}\text{Kr}$ and $^{85}\text{Rb}(n,2n)^{84\text{m}}\text{Rb}$ reactions	103
5.5.1 Data Analysis	103
5.5.2 Theoretical Calculations	115
5.5.3 Results and Discussion	117
5.6 Conclusion	119
References	121
6 Summary, Conclusions and Future Work	
6.1 Summary and Conclusions	128
6.2 Future Work	130