Preface

The development of the nuclear reactors with the safe use of nuclear operation and nuclear proliferation are the focus of the research from the several decades. After the discovery of tokamak, our vision to the production of power from nuclear fusion becomes important. The present research is focused not only in the direction of the conventional fission reactor but also for the development of the safe fusion reactor. In view of this, the International Thermonuclear Experimental Reactor (ITER) is under construction at Cadarache, France. The production of neutrons and photons in the fission and fusion reactor demands the nuclear data for the further development which is based on the reduction of the nuclear waste production, reduction of the transmutation of the structural materials and long life of the reactor. A complete data set is useful to fulfill these objectives, which enhance the nuclear data libraries. Further for the nuclear data is important for the nuclear transport calculations.

The present work is based on the theme of the nuclear data for the neutrons and photons to enhance the nuclear data libraries and the validation of the nuclear reaction models. The entire work can be divided into two parts, the study of photo induced nuclear reactions and study of neutron induced nuclear reactions. The mechanism of the giant dipole resonance was explained with the derivation of empirical formula using different terminology than the conventional. The validation of the formula for isotopes with $Z \geq 60$ has been done with the experimental data available in EXFOR data library and nuclear modular codes TALYS – 1.6 and EMPIRE – 3.2.2.

In addition to the above, neutron induced nuclear reaction experiments are performed at BARC – TIFR Pelletron facility, Defense Lab Jodhpur and at BHU in the energy range from 1 MeV to 20 MeV for some

structural isotopes. The offline gamma ray spectroscopy and neutron activation analysis technique were used for the data measurement and analysis. The measured cross section data were computed using different models available in TALYS – 1.6/1.8 and EMPIRE – 3.2.2 and compared.

Overall the present thesis has been made in view of providing nuclear data that can be compiled for the nuclear data libraries.