

Contents

Acknowledgements	iii
Research Publications	iv
Synopsis	v
1 Introduction	1
2 Review of Electroweak Model	6
2.1 The $SU(2) \otimes U(1)$ gauge theory	6
2.2 Giving mass to the particles	8
2.3 Current mass and Physical mass	11
2.4 The quark mixing matrix	12
2.5 \mathcal{CP} violation and quark mixing	17
2.6 \mathcal{CP} violation in neutral meson systems	19
2.6.1 The Neutral Kaons system	19
2.6.2 The Neutral Beauty meson system	24
3 Symmetric Quark Mixing & Some Consequences	26
3.1 Symmetric Ansatz for quark mixing	26
3.1.1 CKM matrix with symmetric moduli	26
3.1.2 Generalised two-angle parametrization	27
3.1.3 Restrictions on the eigenstates and eigenvalues	29
3.2 Consequences of Symmetric quark mixing	29

3.2.1	Top Quark Mass and a Symmetric CKM matrix	29
3.2.2	Symmetric CKM matrix and Quark Mass matrices	32
3.2.3	Rank One quark mass matrices and Phenomenological constraints	42
4	Studies related to massive neutrinos	46
4.1	Review of neutrino masses and mixing	46
4.1.1	Neutrino Mass	46
4.1.2	Lepton Mixing and Neutrino Oscillations	51
4.1.3	Experimental Evidences	54
4.2	17 keV Nondegenerate Majorana Neutrino and neutrino mixing	54
4.3	Potential Minimisation in Left-Right symmetric models and neutrino masses . .	61
4.3.1	Introduction	61
4.3.2	Rudiments of Left-Right symmetric model	61
4.3.3	Minimization of potential	63
4.3.4	Introduction of extra fields	66
4.3.5	Details of potential minimization	68
4.3.6	Neutrino mass matrix	69
4.3.7	Conclusion	70
5	Summary and Conclusions	71
5.1	Studies related to quarks	71
5.2	Studies related to neutrinos	72
Bibliography		74