CHAPTER – 7

CONCLUSION AND SCOPE FOR FUTURE WORK

• To avoid permanent immobility of the arthritis patients or patients who has damaged his/her joint from the accidents, total knee prosthesis is a must. From the results of non-contact analysis it is noticed that decreasing the sagittal radius the TKR design leads to decrease in the shear stress their by wear is also reduced. Also, the results reveal that the strength of polyethylene chopped fibre is higher than regular polyethylene. Therefore polyethylene chopped fiber can be successfully used for TKR design instead of polyethylene.

• From the results of contact analysis it is noticed that increase in flexion angle and sagittal radius, induces higher stresses at the interface of prosthetic femerotibial joint. Also, it is proved that the alumina ceramic and UHMWPE with chopped carbon fibers combination is proved to be better combination at higher flexion angles and sagittal radius.

• The alumina ceramic and polyethylene chopped fiber combination is proved to be better combination compared with titanium alloy/ polyethylene chopped fiber combination and stainless steel/ polyethylene chopped fiber combination. At the peak load 2667 N, the reduction in stress level is 32% for maximum shear stress and 37% for Von Mises stress by using polyethylene chopped carbon fiber as tibia material and alumina ceramic as femur.

• From the results of thermal analysis, at high temperature in the human body the maximum heat flux and maximum temperature values at contact are high in case of alumina ceramic femur and polyethylene (UHMWPE) tibial insert combination compared to titanium alloy/polyethylene and stainless steel/polyethylene combinations.
at any flexion angle. The high temperature status of human body is intermittent. As a weight bearing joint, femorotibial joint has to withstand high compressive loads at different flexion angles. Hence, alumina ceramic femur and polyethylene chopped carbon fiber tibia combination appears to be a very promising one for prosthetic knee due to high mechanical strength and high wear resistance of the materials.

- Therefore alumina ceramic and UHMWPE with chopped carbon fibers combination can be successfully used for prosthetic knee design for deep flexion and higher sagittal radius.

**SCOPE FOR FUTURE WORK**

- The analysis can be done for deep flexion angles
- Thermal stresses at high temperature can be investigated
- Different orientation of carbon fibers in polyethylene matrix can be considered
- The results of analysis of femorotibial joint of a particular material combination can be verified by using a knee simulator