SYNOPSIS

This thesis presents the various aspects of a study carried out for *numerical modelling of unsteady flow over a fluvial bed in a tidal reach*. The one dimensional long wave free surface equations of mass and momentum for tidal motion have been analyzed numerically adopting finite difference methods. A review of existing finite difference schemes has been made specially with regard to their accuracy and stability. The discretization of the governing equations adopting various explicit and implicit finite difference schemes have been carried out for analysis of tidal propagation in physical model as well as for solving the tidal propagation problems under actual field conditions. The formulation of difference equations has been made so that it can take care both of schematized and irregular river cross section.

Of all implicit methods Preissmann's four point scheme has been specially selected as the standard solution technique. The formulation of the difference equations has been made as per the procedure suggested by *Preissmann*. However a modified version of the double sweep solution procedure has been developed by the investigator in order to have faster convergence as well as less Central Processing Unit (CPU) time. The complete computational formulation and solution techniques of the Preissmann scheme with general boundary condition has been indicated in the appropriate flow diagram. A software program complete with various subroutines has also been developed and incorporated in

the thesis. Apart from above detailed formulation of other computational schemes such as *Abbott's six point* implicit scheme, *Leap-Frog* and *MacCormack* explicit schemes have also been made along with development of suitable software programs. The programs are capable of handling the general boundary conditions. Before starting processing the experimental data collected from the physical model the calibration of the model has been done with respect to initial conditions.

An experimental study has been carried out to study tidal propagation problem on a physical model of a tidal river reach. Eight number of experimental runs with various hydrological conditions have been carried out. The results are then compared with the computed values following Preissmann scheme. For one experimental run the computations have been carried out by other schemes also, for comparison purpose. Results incorporating various production runs for tidal levels, velocities, discharges, and simultaneous tide curves have been shown graphically for various schemes. The measured values have also been indicated in the graphs wherever applicable for facility of comparison. The other derived informations from the production runs such as time of occurrence of low and high water, maximum flood and ebb velocities, discharges along with their values have been shown in tabular form. In general it has been observed that there is good agreement between the measured and computed water levels in all the schemes. However the discrepancies in the measured and computed values specially in the experimental runs involving velocity measurements has been observed and the possible reasons have been discussed.