BONAFIDE CERTIFICATE

This is to certify that the project report entitled "**Comparative Study of Gamma Hydrograph and SUH Methods for Flood Estimation in Ungauged Catchments**" is a record of the bonafide dissertation work carried out by me, ABHAY SHARMA, towards the partial fulfilment of requirements for the award of the degree of Master of Technology in Hydraulics & Flood Control Engineering.

Also, I do hereby state that I have not submitted the matter embodied in this thesis in any other University/Institute for the award of any degree as per my knowledge and belief.

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This is to certify that the above made statements made by the candidate are correct to the best of my knowledge.

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ABSTRACT

Flood estimation is very important for efficient design and safe construction of hydraulic structures. Inaccurate estimations may lead to under design or over design off structure thus causing heavy damage to life and property or excessive cost of the structure. In gauged catchments, frequency analysis of flood peaks is used to calculate a required return period flood as adequate flood data are available in such regions. In ungauged catchments, regional approach is adopted for flood estimation due to inadequate flood data. In synthetic hydrograph method, UH parameters are correlated with geomorphologic parameters rather than available rainfall-runoff data for reliable flood estimation. UH parameters are calculated and a curve is fitted through these points by trial method (maintaining area under curve) which is a very complex and time consuming method. Use of hit and trial method can be avoided if Probability Density Functions such as such as Gamma, Chi –Square, Beta etc are used. These functions have the advantage that area under curve is unity and shape is known. Gamma Distribution Function (GDF) has been used in the present study for calculation of UH parameters and the required return period flood of Chambal Subzone 1(b). Results indicate that UH parameters calculated using GDF is in close agreement with the data provided for the subzone and the UH parameters are highly correlated as compared to SUH methods. Peaks of 50 year return period Flood Hydrograph calculated using both SUH and GDF methods have very high correlation coefficient between peak discharge and geomorphologic variables (A, L, S, and $R_{f)}$.

Unit Hydrograph parameters and derived geomorphologic parameters for 26 subzones all over India have been studied. It is found that geomorphological parameters used by CWC for various subzones are better correlated with UH parameters than other proposed geomorphologic parameters ($L/S^{0.5}$, L^2/AS etc). For more accurate studies in a region, multiple correlation method or various probability distribution functions may be studied to find the most accurate method applicable for the region. Variation of UH parameters with Area(A), Length(L) and Slope(S) for various subzones is studied to find the appropriate geomorphologic parameters affecting the behavior of hydrograph parameters in ungauged sites.. Results of peak discharge as a function of A or A/L or A/SL indicate that for small ungauged sites, Q_p may roughly be estimated as a non linear function of area independently, in absence of other geomorphologic data. Geomorphologic study of the region may be carried out in future for better understanding of the area using Arc-GIS.

Contents

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

A	Area of catchment
A.N.N	Artificial Neutral Network
A.R.F	Areal Reduction Factor
C.W.C	Central Water Commission
D.R.F	Duration Reduction Factor
F_f	Form Factor
IUH	Instantaneous Unit Hydrograph
k & n	Shape & Scale parameters of Gamma Hydrograph
L	Length of the catchment
L_c	Distance of the outlet from the nearest gauging site
P.D.F	Probability Distribution Functions
P.R	Point Rainfall
Q_p	Peak Discharge
q_p	Peak Discharge Per Unit Area
qp	Peak Discharge Per Unit Area/Effective Rainfall
r	Coefficient of correlation
R_c	Circulatory Ratio
R_e	Elongation Ratio
S	Slope of the Catchment
SUH	Synthetic Unit Hydrograph
T_c	Time of concentration
T_d	Storm Duration
T_p	Time to Peak Discharge
T_r	Unit Rainfall Duration in hours
UH	Unit Hydrograph
V	Volume
W.C	Width of the catchment

W_{50}	Unit Hydrograph Width at 50% Q_p
W_{75}	Unit Hydrograph Width at 75% Q_p
WR_{50}	Time between T_p and 50% Q_p on accession curve
WR_{75}	Time between T_p and 75% Q_p on accession curve
α	Dimensionless constant in gamma distribution function
β	Dimensionless constant as product of qp & T_p