

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. Sem. – IInd - Examination – June/July- 2011****Subject code: 1721206****Subject : Stochastic Models in Water Resources****Date: 29/06/2011****Time: 10:30 am – 01:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Define deterministic process, probabilistic process and stochastic process giving examples of each and hence explain the importance of stochastic modeling in hydrological processes. **07**
- (b)** Explain the concept of method of least squares. Fit a trend line to the following data by method of least squares, in terms of mean flow and time. Flow is in cumecs. **07**

Year	1970	71	72	73	74	75	76	77	78	79	1980
Flow	49.5	37	43	44.5	39	38	32	39	42	41	34

- Q.2 (a)** The first serial correlation coefficient of MA(1) process is 0.3. Determine the parameters of the process. **07**
- (b)** (i) Define discrete random variable and continuous random variables. **07**
(ii) Enlist the probability distribution functions used for the analysis of hydrological flow data. Give the salient features of the normal distribution.

OR

- (b)** (i) Explain using the central limit theorem or otherwise why normal distribution is very useful in analyzing the hydrological processes of large time interval. **07**
(ii) Give the reasons for the use of Gumbel's distribution to model annual peak discharges.

- Q.3 (a)** Give the significance of the following descriptors of the probability distribution function: mean, variance, skewness coefficient, and Kurtosis coefficient. **07**
- (b)** Define stationary and non stationary series and explain the checks applied for checking the stationarity of the time series. Define weakly and strongly stationary series. **07**

OR

- Q.3 (a)** Enlist the various components of a time series. How are the trend components analyzed? **07**
- (b)** Explain in detail why multivariate models are required for the analysis of the hydrological process. **07**

- Q.4 (a)** Write mathematical expressions for the first and second order AR and MA models and explain the significance of each term contained in the expressions. **07**

- (b) Define autocorrelation function and state the importance of autocorrelation analysis. Enlist the properties of autocorrelation coefficient. 07

OR

- Q.4 (a) Write down the Thomas- Fiering model for generation of seasonal flows. Explain clearly the importance of each term in the model and explain how the non seasonality and cyclicity of seasonal flows preserved in this model. 07

- (b) Check the stationarity of the following second order AR process: $(X_t - \mu_x) = 1.5(X_{t-1} - \mu_x) - 0.5(X_{t-2} - \mu_x) + \xi_t$, where the terms have their usual meaning. 07

- Q.5 (a) Define the following and explain their importance with respect to hydrological data: harmonic and geometric mean; covariance and independent series. 07

- (b) Draw sketches to show the Gaussian or normal distribution and a skewed distribution. Mark mean median and mode on the two distributions Define mean, median and mode for continuous random variables. 07

OR

- Q.5 (a) Explain the transient component of the deterministic series and its importance. 07

- (b) Explain why the runoff volume in any particular year should depend upon the run off volume in the previous year. Therefore explain the suitability of AR(1) models for knowing the annual flows. 07
