# GUJARAT TECHNOLOGICAL UNIVERSITY

**CIVIL (WATER RESOURCES ENGINEERING) (33)**
**Master of Engineering**
**Subject Code: 3733302**
**Semester – III**
**Subject Name: Stochastic Models in Water Resources**

**Type of course: Program Elective-V**

**Prerequisite: Knowledge of statistics, probabilities and modeling.**

**Rationale:**
Students will be able to understand probability distribution, structure of hydrological time series, trend and seasonality and various models utilized in stochastic hydrology.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 2 | 0 | 2 | 3 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | Concept of Probability, Distribution Function, Parameter Estimation, Method of Moments. | 6 |
| 2 | Maximum Likelihood, Least square, Probability Distribution, Structure of hydrological time series, trend and seasonality | 10 |
| 3 | Auto covariance and correlation function, Spectral analysis, data generation techniques. | 10 |
| 4 | Linear stochastic models, stochastic optimization Techniques, AR models, MA models, ARMA models, Modelling of non-stationery time series, Seasonal series, Thomas-Fiering Model, ARIMA Models, Periodic Models, Multi-Site Modelling | 6 |

**Reference Books:**


1. Jayarami Reddy P., Stochastic Hydrology, Laxmi Publication, 2003.
2. Hippel K.W., McLeod A.I., Panu U.S., Singh V.P., Fang L., Stochastic and Statistical Methods in Hydrology and Environmental Engineering, Springer, 1994.
3. Marco J.B., Harboe R., and Salas J.D., Stochastic Hydrology and Its Use in Water Resources Systems Simulation and Optimization, NATO Advanced Study Institute, Peniscola, Spain, September 18-29, 1989.

4. McCueen, R.H. and Snyder, W.M., Hydrological Modeling - Statistical Methods, and applications, Prentice Hall, 19985 Irrigation Water Resources - Dr.P.N.Modi

**Course Outcomes: At the end of the course, Student will be able to**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Perform statistical analysis of hydrological data | 20 |
| CO-2 | Apply data generation techniques to solve problems | 15 |
| CO-3 | Trend analysis over time series data | 20 |
| CO-4 | Create different modeling environment with data significance | 25 |
| CO-5 | Projections and forecasting of natural phenomenon | 20 |

**Suggested Specification table with Marks (Theory): (For ME only)**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| **R Level** | **U Level** | **A Level** | **N Level** | **E Level** | **C Level** |
| **10%** | **20%** | **20%** | **20%** | **15%** | **15%** |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

**Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.**

**List of Practical:**

The practical may include study of different models and their applications. Data Collection for modeling and simulation. Study of various literatures of practice and implementation. The students will work in group for the modelling and analysis based on syllabus such as;

1. Problem based on mean model
2. Mediation and standard deviation
3. Probability distribution
4. Auto covariance and correlation function
5. Spectral analysis
6. Problem on data generation techniques
7. Trend analysis of flood data

**List of Open Source Software/learning website:**

1. http://www.nptel.iitm.ac.in/courses/