



# MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

## COURSE CONTENT

| MANUFACTURING SYSTEMS: SIMULATION MODELLING & ANALYSIS  |          |                     |   |                       |         |                        |     |                   |
|---|----------|---------------------|---|-----------------------|---------|------------------------|-----|-------------------|
| I Semester: M.Tech (CAD/CAM)  |          |                     |   |                       |         |                        |     |                   |
| Course Code   | Category | Hours / Week        |   |                       | Credits | Maximum Marks          |     |                   |
|   |          | L                   | T | P                     |         | C                      | CIA | SEE               |
| 2424004   | Advanced | 3                   | 0 | 0                     | 3       | 40                     | 60  | 100               |
|   |          | Contact Classes: 45 |   | Tutorial Classes: Nil |         | Practical Classes: Nil |     | Total Classes: 45 |
| Prerequisites: Operations Research, Optimization Techniques and Applications and Probability Statistics |          |                     |   |                       |         |                        |     |                   |

### Course Overview:

This course introduces system modeling and simulation, covering types of models, simulation steps, and statistical concepts like estimation and hypothesis testing. It focuses on building, verifying, and validating simulation models, along with modeling stochastic inputs. Students learn random variate generation methods and simulation languages. The course also addresses output data analysis techniques, including steady-state analysis. Finally, it explores practical applications such as queueing systems, inventory models, and production systems, enabling effective decision-making using simulation techniques.

### Course Objectives:

1. Learn way of analyzing the systems.
2. Classification of systems-based nature of dynamics and knowledge of elements.
3. To develop simulation model for dynamic discrete – event stochastic system.
4. To run the model and collect the data.
5. To analyze the output data of simulation for specified for performance measures bases on type of simulation and method of output data analysis.

### Course Outcomes: After Completion of the Course, Students should be able to

1. Define the state of system W.R.T specified performance measures.
2. Develop simulation model for the said system
3. Generate random variates and learn various simulation languages.
4. Analyze through simulation the model and present the results to specified confidence level.
5. Apply simulation for flow shop systems and job shop systems.

### UNIT - I:

System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation– estimator – properties – estimate – point estimate – confidence interval estimates – independent –dependent – hypothesis – types of hypothesis- steps – types 1& 2 errors – Framing – strong law of large numbers.

### UNIT - II:

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

### UNIT - III:

Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform

– weibull– normal Bernoullie – Binomial – uniform – poison. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features– statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

#### **UNIT - IV:**

Output data analysis – Types of Simulation with respect to output data analysis – warm up period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons.

#### **UNIT –V:**

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – New boy paper problem.

#### **TEXT BOOKS:**

1. Simulation Modelling and Analysis by Law, A.M. & Kelton, McGraw Hill, 2nd Edition, New York, 1991.
2. Discrete Event System Simulation by Banks J. & Carson J.S., PH, Englewood Cliffs, NJ, 1984.

#### **REFERENCE BOOKS:**

1. Simulation of Manufacturing Systems by Carrie A., Wiley, NY, 1990.
2. A Course in Simulation by Ross, S.M., McMillan, NY, 1990.
3. Simulation Modelling and SIMNET by Taha H.A., PH, Englewood Cliffs, NJ, 1987.

#### **ELECTRONIC RESOURCES:**

1. <https://nptel.ac.in/courses/112107214>

#### **MATERIALS ONLINE:**

1. Course template
2. Definitions and terminology
3. Lecture notes
4. E-Learning Readiness Videos (ELRV)