# SIMULATION AND MODELING
## BEG471CO

Year IV                                                                 Semester: I

| Teaching Schedule Hours/Week | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|
| Theory | Tutorial | Practical | Internal Assessment | | Final | | Total |
| | | | Theory | Practical* | Theory** | Practical | |
| 3 | 1 | 2 | 20 | 25 | 80 | - | 125 |

**Course Objectives**: This course provides the discrete and continuous system, generation of random variables, and analysis of simulation output and simulation languages.

**1. Concept of simulation**                                              **6 hr**
1.1 Introduction
1.2 The system
1.3 Continuous and discrete systems
1.4 System simulation
1.5 Real time simulation
1.6 When to use simulation
1.7 Types of simulation model
1.8 Steps in simulation study
1.9 Phases of simulation study
1.10 Advantages of simulation
1.11 Limitations of the simulation Technique
1.12 Areas of applications

**2. Monte Carlo Method**                                                **4 hr**
2.1 Monte Carlo Method
2.2 Normally distribution random number
2.3 Monte Carlo Method V/S stochastic Simulation

**3. Simulation of Continuous systems**                                  **5 hr**
3.1 A pure Pursuit Problem
3.2 Continuous system models
3.3 Analog Computer
3.4 Analog Methods
3.5 Hybrid Simulation
3.6 Feedback Systems
3.7 Differential and Partial Differential Equations and its Engineering Purpose

**4. Queuing System**                                                    **5 hr**
4.1 Elements of Queuing System
4.2 Characteristics of Queuing System
4.3 Types of Queuing System

4.4 Queuing Notation
4.5 Measurement of System Performance
4.6 Application of Queuing System
4.7 Markov Chain

## 5. Verification & Validation of Simulation Models                  5 hr

5.1 Model building
5.2 Verification & Validation
5.3 Verification of Simulation Models
5.4 Calibration & Validation of Models

## 6. Random Number                                                    8 hr

6.1 Random Numbers
6.2 Random Number Tables
6.3 Pseudo Random Numbers
6.4 Generation of Random Numbers
6.5 Mid square Random Number generator
6.6 Qualities of an efficient Random Number generator
6.7 Testing Numbers for Randomness
6.8 Uniformity Test
6.9 Chi-square Test
6.10 Testing for auto correlation
6.11 Poker Test

## 7. Analysis of simulation Output                                    5 hr
7.1 Estimation Methods
7.2 Simulation run statistics
7.3 Replication of runs
7.4 Elimination of internal bias

## 8. Simulation Language                                              7 hr
8.1 Basic concept of Simulation tool
8.2 CSSLs, GPSS
8.3 Discrete systems modeling and simulation
8.4 Continuous systems modeling and simulation
8.5 Structural, data and control statements hybrid simulation
8.6 Feedback systems: typical application

## Laboratories
Laboratory exercises using simulation and modeling package, at the end of this course last student must do a project on simulation using simulation and modeling package.

## Recommended Books

1. G. Gordan, "System Simulation", Prentice Hall of India.
2. M. Law and R.F. Perry, "Simulation: A problem solving approach", Addison Wesley publishing company.
3. M. Law and W.D. Kelton,"Simulation Modeling and Analysis", Mc Graw Hill, 1991.
4. Jerry Banks, John S.Carson II, Barry L. Nelson, Devid M. Nicol, P.Shahabudden: Discrete –Event System Simulation
5. R.Y. Rubinstein, B. Melamed: Modern Simulation And Modelling