



**Simulation and Modeling**  
**BIT354CO**

Year:IV

Semester:II

Teaching Schedule Hours/Week			Examination Scheme			
Theory	Tutorial	Practical	Internal		Final	Total
3	1	2	Theory	Practical	Theory	Practical
			20	50	80	-
						150

**Course Objectives:**

The objectives of this course are to introduce students to simulation and Modeling techniques and to provide opportunities to develop basic simulation and modeling skills with respect to carrying out projects using any simulation method on the computer.

**1. Concepts of Simulation**

[6 Hrs]

- 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 Models
- 1.8. Steps in simulation Study
- 1.9. Phases of a simulation study
- 1.10. Advantages of simulation
- 1.11. Limitations of the Simulation Technique
- 1.12. Areas of applications

**2. Monte Carlo Method**

[ 4 Hrs]


- 2.1. Monte Carlo Method
- 2.2. Normally distributed random number
- 2.3. Monte Carlo Method V/S Stochastic Simulation

**3. Simulation of Continuous Systems**

[5 hours]

*[Signatures]*



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- 3.1. Manual Simulation
  - 3.2. A pure Pursuit Problem
  - 3.3. Queuing system
  - 3.4. Markov chains
  - 3.5. Differential and partial differential equations

[10 hours]

- 4. Random Numbers
  - 4.1. Random Numbers
  - 4.2. Random Number Tables
  - 4.3. Pseudo Random Numbers
  - 4.4. Generation of Random Numbers
  - 4.5. Mid square Random Number generator
  - 4.6. Qualities of an efficient Random Number Generator
  - 4.7. Testing Numbers for Randomness
  - 4.8. Uniformity Test
  - 4.9. Chi-square test
  - 4.10. Testing for auto correlation
  - 4.11. Poker Test

[10 hours]

- 5. Analysis of simulation output
  - 5.1. Estimation methods
  - 5.2. Simulation run statistics
  - 5.3. Replication of runs
  - 5.4. Elimination of internal bias

[10 hours]

- 6. Simulation languages
  - 6.1. Basic concept of Simulation tool
  - 6.2. Discrete systems modeling and simulation
  - 6.3. Continuous systems modeling and simulation
  - 6.4. Structural, data and control statements, hybrid simulation
  - 6.5. Feedback systems: typical applications

#### Laboratory works:

There shall be laboratory exercises using any simulation and modeling packages. At the end of this course students must do a project on simulation.

#### References books:

- 1. G. Gordon, " 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", McGraw Hill, 1991.

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# PURBANCHAL UNIVERSITY

2024

Bachelor in Information Technology (B.I.T.)/Sixth Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

**BIT354CO: Simulation & Modeling (New Course)**

Candidates are required to give their answers in their own words as far as practicable. Figure in the margin indicate full marks.

## Group A

Answer **TWO** questions.

2×12=24

1. What are the distinct phases of a comprehensive simulation study? Explain the tasks that each phase encompasses.
2. What are the properties of random number? The sequence of numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use the Kolmogorov-Smirnov test  $\alpha=0.05$  to determine if the hypothesis that the numbers are uniformly distributed on the interval 0 to 1 can be rejected.  
(Note that the critical value of D for  $\alpha=0.05$  and  $N=5$  is 0.565)
- 3(a) Explain about Kendal's notation with an example.  
(b) Write down the applications of real-time simulation.

## Group B

Answer **SEVEN** questions.

7×8=56

4. Discuss about the limitations or challenges of using simulation languages for modeling complex systems.
5. What are continuous and discrete systems, and what types of systems do they represent? Give examples.
6. What do you mean by Poker test? Write the significance of testing numbers for randomness in statistical analysis.
7. What is a queuing system and what are the key components involved?
8. Describe Monte Carlo simulation and state the scenarios of using Monte Carlo method over other simulation methods.
9. Define and describe Markov chain with example.
10. What are the different estimation methods used in analyzing simulation output? Elaborate on the process of estimating internal bias in simulation.
11. List any five circumstances when the simulation is appropriate tool and when it is not.
11. Write short notes on:  
(a) Hybrid simulation  
(b) Use of partial differential equation in simulation model

2×4=8