



Course Title: MODELING AND SIMULATION IN WIRELESS COMMUNICATION

Course Code: ECE641

Credit Units: 6

Level: PG

L	T	P/ S	SW/F W	TOTAL CREDIT UNITS
3	1	4	0	6

Course Objectives: The purpose of this course is to provide a thorough introduction to modeling & simulation techniques of wireless communication systems. It provides indepth knowledge of estimation of parameter measures and testing process of the wireless communication system. It also deals with the concept of performance evaluation of any communication system including channel models.

Prerequisites: Digital Communication

Course Contents/Syllabus:

	Weightage (%)
Module I : Introduction to Modelling and simulation	20%
<ul style="list-style-type: none">• Methods of performance evaluation-simulation - Advantages and drawbacks.• System model steps and its types involved in simulation study.• Basic concepts of modeling – modeling of systems, devices, random process and hypothetical systems.• Error sources in simulation. Validation, simulation environment and software issues.• Role of simulation in communication system and random process. Steps involved in simulation study	
Module II: Generation, Testing and parameter estimation	20%
<ul style="list-style-type: none">• Monte Carlo simulation,• Properties,• Random number Generation,• Generating independent and• Correlated random sequences .• Testing of random number generators.• Parameter estimation: Estimating mean,• Variance, confidence interval,• Estimating the Average Level of w/f• Estimating the Average power of a waveform,	

<ul style="list-style-type: none"> • Power Spectral Density of a process, • Delay and Phase. 	
Module III: Communication system modelling	20%
<ul style="list-style-type: none"> • Information sources, • source coding, • base band modulation, • channel coding, • RF and optical modulation, filtering, • multiplexing, detection/demodulation- carrier and timing recovery for BPSK and QPSK. Modeling considerations for PLL. 	
Module IV: Communication channel models	20%
<ul style="list-style-type: none"> • Fading and multipath channels- statistical characterization of multipath channels and time-varying • Channels with Doppler effects, models for multipath fading channels. Finite state channel models – • channels with and without memory. Methodology for simulating communication systems operating over fading channels. 	
Module V: Performance Estimation and Evaluation	20%
<ul style="list-style-type: none"> • Estimation of Performance Measures – • Estimation of SNR, Performance Measures for Digital Systems, • Importance sampling method, • Efficient Simulation using Importance Sampling, • Quasi Analytical Estimation. 	

Student Learning Outcomes:

Outcome 1: Students will be able to analyze modeling and simulation of various communication networks

Outcome 2: Students will be able to generate test and estimate parameters.

Outcome3: By the end of the course, students will apply this knowledge for detection estimation and simulation of various communication networks.

Pedagogy for Course Delivery: The class will be taught using theory and other computer aided methods. In addition to class room teaching various assignments and tutorials will be carried out, The course instructor will spend considerable time in understanding the concept of innovation and make students understand and realize the practicality of the course.

List of Laboratory Experiment:

1. To Study the flow of operation in QualNet Network Simulator GUI
2. To Configure an Adhoc mode scenario in QualNet Network Simulator GUI
3. To Configure an Infrastructure mode scenario in QualNet Network Simulator GUI
4. To Compare different routing protocols in an Adhoc mode scenario
5. To See the effect of mobility to the data transferred in an Adhoc mode scenario
6. To Configure VoIP application layer protocol based on H.323 in an Infrastructure mode scenario
7. To Check the effect of bottleneck in a wired scenario Assessment/ Examination Scheme:

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
66.67%	33.33%	100%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Mid-Term Exam	Assignment	Viva	Attendance	
Weightage (%)	10%	7%	8%	5%	70%

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Lab Assessment (P):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Attendance	PR	LR	Viva	
Weightage (%)	5%	10%	10%	5%	70%

A: Attendance, PR- Performance, LR – Lab Record, V – Viva. EE- External Exam,

Text Books:

- . M.C. Jeruchim, Philip Balaban and K.Sam shanmugam. “Simulation of communication systems,” Plenum press, New York, 2007.
- M.Law and W.David Kelton ,” Simulation Modelling and analysis,” McGraw Hill, New York, 2008.

Reference Books:

- K.Hayes, “Modelling and Analysis of computer communication networks,” Plenum press, New York, 1984.
- Banks, J.S.Carson, Nelson and D.M.Nicol, “Discrete –Event system simulation,” Prentice Hal.