DEPARTMENT OF CIVIL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**M. Tech. (Transportation Engineering and Management)**		
Course Title	**COMPUTATIONAL TECHNIQUES IN TRANSPORTATION ENGINEERING**		
Course Code	**CE612**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	None		
Session	**July 2018**	**Section (if, applicable)**	**N.A.**
Name of Faculty	**Dr. S. Moses Santhakumar**	**Department**	Civil Eng
Email	moses@nitt.edu	**Telephone No.**	**9842450011 (M) 3155 (O)**
Name of Course Coordinator(s) (if, applicable)	**N.A.**		
E-mail		**Telephone No.**	
Course Type	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

Introduction to systems approach - Typical transportation systems - Mathematical models. Fundamentals of simulation - Monte Carlo method - Continuous and discrete models - Simulation languages. Probability concepts - Random numbers - Pseudo random generators - Arrival patterns - Service time distributions – Manual simulation of simple queuing system

GPSS Fundamentals - Creating and moving transactions - Queues and facilities - Event scheduling – Standard numerical attributes – Parameters and savevalues - Functions - Priority - Preemption - Collection of statistics - Report preparation. Internal logic of GPSS processor - Program control statements.

Applications of GPSS - Simple queuing problems - Inventory problems - Simulation of ports - Railway platforms and level crossings - Traffic signals. Analysis of simulation results - Model validation - Replication of random conditions - Time series analysis.

Genetic Algorithm - Terminology in GA – Strings, Structure, Parameter string - Data Structures – Operators - Algorithm – Application in Transportation. Fuzzy Logic.

Artificial Neural Networks - Basics of ANN – Topology - Learning Processes - Supervised and unsupervised learning. Least mean square algorithm, Back propagation algorithm - Applications.

Reference books:

1. Gordon, G., *System Simulation,* Prentice-Hall of India, 2005
2. GPSS/PC, *User Manual, Minuteman Software,* USA, 2005
3. David E. Goldberg, Genetic Algorithms in Search, Optimisation and Machine Learning, Addison-Wesley, 1989
4. J.M. Zurada, .Introduction to artificial neural systems., Jaico Publishers, 2006.

COURSE OBJECTIVES

- To be introduced to systems approach
- To learn the fundamentals of simulation and the GPSS language
- To learn applications of GPSS in transportation systems
- To be introduced to the fundamentals of Genetic Algorithm
- To learn the application of Artificial Neural Networks.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
1. Working knowledge of simulation	a f h
2. Ability to develop programs in GPSS	a b c e g i
3. Good understanding of GA applications	a b c e g i
4. Ability to apply ANN	a b c e g i
5. Working knowledge of mathematical models	a b c e g i j

COURSE PLAN – PART II

COURSE OVERVIEW

To understand the principles of systems analysis, and learn computational techniques such as Simulation, Genetic Algorithm and Artificial Neural Networks.

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	Week 1	• Syllabus and course content • Introduction to systems approach • Mathematical models • Fundamentals of simulation	• Chalk and Board • PPT
2	Week 2	• Continuous and discrete models • Simulation languages • Probability concepts • Random numbers	• Chalk and Board • PPT
3	Week 3	• Pseudo random generators • Arrival and Service time distributions • Manual simulation of simple queuing systems • Comparison with analytical results	• Chalk and Board • Tutorials
4	Week 4	• GPSS Fundamentals • Creating and moving transactions • Queues and facilities	• Chalk and Board
5	Week 5	• Event scheduling • Standard numerical attributes • Parameters and savevalues	• Chalk and Board • Tutorials
6	Week 6	• Functions • Priority • Preemption • Time measurement	• Chalk and Board • Tutorials
7	Week 7	• Cycle Test I	
8	Week 8	• Collection of statistics • Report preparation • Internal logic of GPSS processor • Program control statements	• Chalk and Board • Tutorials

9	Week 9	• Applications of GPSS • Simple queuing problems • Inventory problems	• Chalk and Board • Tutorials
10	Week 10	• Simulation of ports and airports • Railway platforms and level crossings • Traffic signals	• Chalk and Board • Tutorials
11	Week 11	• Analysis of simulation results • Model calibration and validation • Time series analysis	• Chalk and Board • Tutorials
12	Week 12	• Scenario analysis • Replication of random conditions • Monte Carlo method • Simulation of continuous systems	• Chalk and Board • Tutorials
13	Week 13	• Cycle Test II	
14	Week 14	• Genetic Algorithm • Terminology in GA • Strings, Structure, Parameter string • Data Structures	• Chalk and Board • PPT
15	Week 15	• Operators • Algorithm • Application in Transportation • Fuzzy Logic	• Chalk and Board • Tutorials
16	Week 16	• Artificial Neural Networks • Basics of ANN • Topology • Learning Processes	• Chalk and Board • PPT
17	Week 17	• Supervised and unsupervised learning • Least mean square algorithm • Back propagation algorithm • Applications	• Chalk and Board • Tutorials

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test 1	Week 7	1 hour	20
2	Cycle Test 2	Week 13	1 hour	20
3	Assignment	Mini-project on simulation of real-world system		10
CPA	Compensation Assessment*	Week 17	1 hour	20
4	Final Assessment *	Week 18	3 hours	50

***mandatory**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

It is proposed to take feedback from the students, at the end of the semester to evaluate the execution of the course.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

1. **Email on** moses@nitt.edu
2. **Phone on 9842450011 (M) or 3155 (O)**
3. **Whatsup on 9842450011**

COMPENSATION ASSESSMENT POLICY

Compensation Assessment will be administered (at the end of the course) to those students who had missed Cycle Test 1 or 2 for valid reasons. The portions for Compensation Assessment will be the combined portions for Cycle Tests 1 or 2.

The students who wish to appear for the Compensation Assessment should obtain prior permission from the HoD.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

Grading will be done with normalized score.

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____