

# Course Brochure

## GLOBAL INITIATIVE OF ACADEMIC NETWORKS



## International Summer Course – 2016

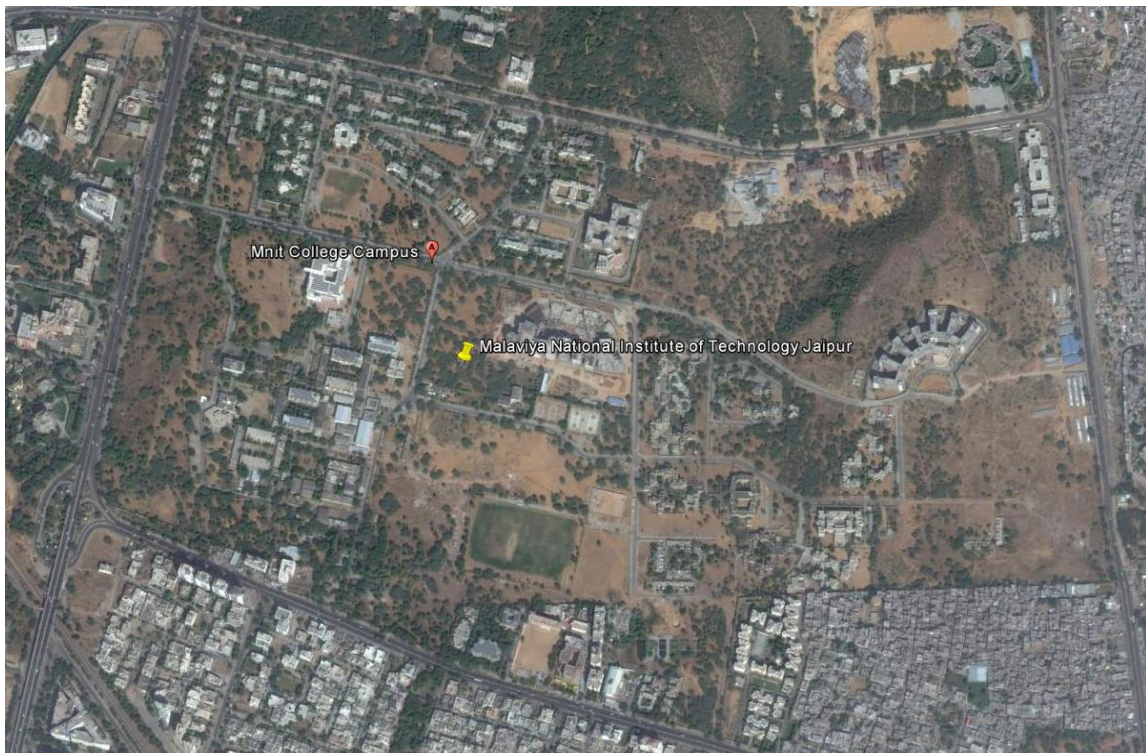
On

## Land Use/ Land Cover Change Modelling and Prediction

(July 04 – 08, 2016)

*Course Coordinators*

**Dr. Mahesh Kumar Jat and Prof. Sudhir Kumar**



*Organised by*

Department of Civil Engineering

**Malaviya National Institute of Technology Jaipur**

Jaipur – 302017 (Rajasthan), India

# Land Use/ Land Cover Change Modelling and Prediction

## About GIAN (An Initiative of Government of India)

Govt. of India approved a new program titled Global Initiative of Academic Networks (GIAN) in Higher Education aimed at tapping the talent pool of scientists and entrepreneurs, internationally to encourage their engagement with the institutes of Higher Education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence. GIAN is envisaged to catalyse higher Education Institutions in the country that will initially include all IITs, IIMs, Central Universities, IISc Bangalore, IISERs, NITs and IIITs, also subsequently cover good State Universities where the spinoff is vast. GIAN is an evolving scheme which will initially include participation of foreign faculty in Institutes as Distinguished / Adjunct / Visiting faculty / Professors of Practice. They will be delivering their expertise in Short or Semester-long Courses. In addition to Short/Long Term Courses other activities will also be included in due course of time.

## GIAN is envisaged to achieve the following objectives:-

- a) To increase the footfalls of reputed international faculty in the Indian academic institutes.
- b) Provide opportunity to our faculty and students to learn and share knowledge and teaching skills in cutting edge areas.
- c) To create avenue for possible collaborative research.
- d) To increase participation and presence of international students in the academic Institutes.
- e) Opportunity for the students of different Institutes/Universities to interact and learn subjects in niche areas through collaborative learning process.
- f) Motivate the best international experts in the world to work on problems related to India.

## About The Programme

Economic development and population growth have triggered rapid changes to earth land use / land cover over the last two centuries and there is every indication that the pace of these changes will accelerate in the future. The rapid changes of land use/ land cover, particularly in developing nations, are often characterized by rampant urban sprawling, land degradation, or the transformation of agricultural land to urban areas. These changes lead to transformations in the hydrological, ecological, geomorphologic and socioeconomic systems and which are often neglected by policy & decision makers.

Information on land use/ land cover is fundamental to many national/global applications including land use planning, climate change assessment, watershed management and agriculture productivity. Thus need to monitor land use/ land cover is derived from multiple intersecting drivers including the physical climate, ecosystem health and social needs. It is therefore indispensable to examine the changes in land use/ land cover, so that its effect on terrestrial ecosystem can be discerned, and sustainable land use planning can be formulated.

Identifying and evaluating the driving forces that are behind land use/land cover changes remains one of the most difficult exercises that engineers, geographers and environmental

scientists must continually address. The difficulty emerges from the fact that in land use/ land cover systems, multiple actions and interactions between different factors (e.g., economic, political, environmental, biophysical, institutional, and cultural) come into play and make it difficult to understand how the processes behind the changes function. The potential large impact of land use/cover change on the physical and social environment has stimulated research in the understanding of land use change and its main causes and effects.

In recent past various methods/techniques/models have been developed to understand land use /land cover dynamics, change assessment and prediction. Traditional methods for gathering demographic data, censuses, and analysis of environmental samples are not adequate to study dynamic phenomenon like land use /land cover changes due its complex nature. Geospatial data collections and analysis technologies like remote sensing and Geographical Information Systems in association advance methods like Cellular Automata (CA) and Artificial Intelligence Techniques have potential to deal with such complex phenomenon. Land use change models exploit techniques to understand the spatial relationship between historical changes in land use and its driving factors (or proxies for them). Such models are also used to project spatial changes in land use based on scenarios of changes in its drivers. The importance of land use change models is evident from the wide range of existing modeling approaches and applications. Scenario analysis with land use models can support in identifying optimum adaptation measure especially in urban areas to minimize the adverse impacts of climate change, land use planning and policy.

Internationally acclaimed academics, researchers and practitioners with proven knowledge, experience, and demonstrable ability in teaching, consultancy, research, and training in the field of Geographical Information Sciences (GIS) will deliver lectures and discuss case studies of land use change modelling and prediction in the proposed short course.

## **Objectives of the Programme**

The primary objectives of the course are as follows:

- 1) Exposing participants to the fundamentals of land use change, driving forces, uncertainties and prediction,
- 2) Building in confidence and capability among participants in doing land use/land cover classification and mapping using different type of remote sensing data,
- 3) Providing exposure to the participants for land use / land cover change assessment, change modelling methods, change and prediction models and model sensitivity testing,
- 4) Enhancing capability of the participants for scenario modelling, decision making and dealing with planning and development.

## **Course Content**

### **Module-1**

Day 1 – (10:00 – 13:00) Land Use Classification and Mapping

- The difference between LU and LC
- Classification schema and desirable properties
- Some different systems in common use: Anderson, Corine, Global systems
- Using remote sensing to map LU

- Workshop: Land Use Classification with IRS/Landsat/ASTER/MODIS

## **Module-2**

Day 1 – (14:00 – 17:00) Land Use Change: Driving Forces, Uncertainty and Change

- Urbanization, causes and variants: sprawl, informal settlements, planned
- Transportation and communications
- Agricultural trends and forces
- Cadastral maps and LU as a market
- Workshop: Multi-temporal urban mapping

Day 2 - (10:00 – 13:00) Land Use Change: The transition matrix and Markov modeling

- How to compute a transition matrix
- The Markov assumptions
- Measures of classification accuracy and the correspondence matrix
- Workshop: Computing the correspondence matrix accuracy measures

## **Module-3**

Day 2 - (14:00 – 17:00) The Purpose of Modeling and Forecasting

- What is a model?
- What are the properties of a good model?
- Forecasts vs. Predictions and Validation vs. Calibration
- Truth in modeling
- Workshop: Forecasting transitions with pseudo-random number generators

Day 3 - (10:00 – 13:00) Overview and comparison of 19 land-use-change models

- Applications; functionality; domains covered; theory, methodology, data; strengths and weaknesses
- Studies comparing models
- Workshop: Choosing the appropriate model and data

Day 3 - (14:00 – 17:00) Trends in modeling LULCC: CA, GA, neural networks, machine learning

- Trends in LULC data
- Visualizing change
- Agent-based models
- Automating calibration
- Workshop: A simple model in Anylogic

Day 4 (10:00 – 13:00) SLEUTH and the CA models. Open vs. Closed models

- SLEUTH input data
- SLEUTH function
- Advantages of open source models
- Workshop: Downloading and compiling SLEUTH

Day 4 - (14:00 – 17:00) The Evolution and Applications of SLEUTH

- History and versions
- Use of parallel computing
- Key applications
- Reviews of the model
- Links to Multicriteria modeling

- Workshop: Demo City application

## Module-4

Day 5 - (10:00 – 13:00) Model sensitivity testing and Truth in Modeling

- Calibration, validation and proof
- Monte Carlo simulation
- Reproducibility and output
- Workshop: Measuring and visualizing uncertainty

Day 5 - (14:00 – 17:00) Scenario modeling, decision making with models and dealing with planning and the development

- What is a scenario?
- What makes a good scenario set?
- Workshop: Using SLEUTH's exclusion layer to create scenarios

Above module shall constitute around 20-24 hours of contact.

## Who Can Attend

- Professionals working in the field of natural resource mapping & monitoring, land use planners, infrastructure planners and peoples working in the field of geo-spatial technologies.
- Faculty doing research related to LULC change modelling, urban growth assessment & prediction, climate change, land use planning and modeling environmental systems
- UG/PG/Research Students from Civil Engineering, Planning, Geography

## Course Registration Process

### Step 1: One Time Registration

Registration for GIAN courses is not free because of constraint in the maximum number of participants allowed to register for a course. In order to register for any course under GIAN, candidate will have to get registered one time first to GIAN Portal of IIT Kharagpur using the following steps: 1. Create login and password at <http://www.gian.iitkgp.ac.in/GREGN/index> 2. Login and complete the Registration Form. 3. Select Courses 4. Confirm your application and payment information. 5. Pay Rs. 500/- (non-refundable) through online payment gateway. 6. Download and print "pdf file" of your enrolment application form for your personal records and copy of the same to be sent to the Course Coordinator.

### Step 2: Institute Registration

1. Institute registration process is an offline process. Interested candidates are requested to download the Registration Form (docx/pdf).

#### 2. Course Fee (Non-refundable):

The participation fee to attend the short course shall be:

- |  |             |
|--|-------------|
| • Participants from Abroad -                           | US \$ 100.0 |
| • Professionals from Industry/Research Organisations – | Rs. 5000.0  |
| • Faculty from Academic Institutions -                 | Rs. 3000.0  |
| • Research Scholars/Students -                         | Rs. 1000.0  |

The above fee includes the instructional materials, internet facility and snacks between the sessions. The accommodation will be provided on payment basis subject to availability on request otherwise participants will have to make their own stay arrangement.

3. The Registration fee has to be paid via Demand Draft/NEFT, in favour of "**Registrar, MNIT Jaipur**" payable at Jaipur. Payment can also be done through National Electronic Funds Transfer (NEFT) to the account of "Registrar, MNIT Jaipur" (Account No. : 676801700388 ICICI Bank, Branch MNIT Jaipur, IFSC Code: ICIC0006768).
  4. Scan copy of the filled in "Registration Form" along with scan copy of "Demand Draft/ Receipt of NEFT" and Application Form generated in Step 1 must be sent via E-mail to the Course Coordinator of the programme [mkjat.ce@mnit.ac.in](mailto:mkjat.ce@mnit.ac.in); [mahesh.mnit@gmail.com](mailto:mahesh.mnit@gmail.com), on or before June 20, 2016.
  5. Hard copy of the above mentioned documents must reach to the Programme Coordinator of the programme on or before June 25, 2016 by 5 PM. Postal address –  
**Dr. Mahesh Kumar Jat**  
**Associate Professor and Coordinator GIAN Course**  
**Department of Civil Engineering**  
**Malaviya National Institute of Technology Jaipur,**  
**J. L. N. Marg, Jaipur – 302017, Rajasthan, India**
- Duly filled registration forms should reach latest by June 25<sup>th</sup>, 2016
6. Selection will be made purely on First Come First Serve Basis and Eligibility (Subject to fulfilling of the seats available).
  7. Maximum forty (40) participants will be accommodated in the course.
  8. The Brochure and the Registration Form may be downloaded from the Institute website [www.mnit.ac.in](http://www.mnit.ac.in).

### **Important Information**

1. The students will obtain academic credits for this course based on the evaluation and grading process. The host Institute will only provide information on the grading system, subject syllabus and the academic policy. The home/sponsoring University/Institute of the student will be mainly responsible for transferring academic credits.
2. As per the host Institute and instruction from GIAN, the course consisting of 30 lectures is of TWO credits. This credit can be included in the student's marks for seminar/presentation/college tour or any other suitable subject as per the participating Institute/ College rules and regulation.
3. Participants will be provided registration kit and course material covering the entire course.
4. After successful completion of the course, all participants will get participation certificates alongwith grades and credits as per Institute norms.
5. No TA, DA will be provided to the participants.
6. Limited accommodation is available in the Institute campus which will be provided on First Come and First Serve Basis on payment mode.
7. Additional Fees for accommodation (if required):
  - Rs 400/day for Students (Excluding Food Charges)\*
  - Rs 500/day for Faculty (Guest House-Twin Sharing basis, Excluding Food Charges)
  - Food Charges on actual basis
8. List of selected participants will be available on Institute website on June 28, 2016.



## THE FACULTY

### Prof. KEITH C. CLARKE

Prof Clarke is a Geographical Information Sciences (GIS) Professor. He holds Ph. D. from the University of Michigan, specializing in Analytical Cartography. He joined the faculty at the University of California, Santa Barbara in 1996. Dr. Clarke's most recent research has been on environmental simulation modeling, on modeling urban growth using cellular automata, on terrain mapping and analysis, and on the history of the CORONA remote sensing program. Dr. Clarke was a NASA /American Society for Engineering Education Fellow at Stanford University, and in 1992 served as Science Advisor to the Office of Research, National Mapping Division of the U.S. Geological Survey in Reston, Virginia. Since 1997, he has been the Santa Barbara Director of the National Center for Geographic Information and Analysis. Dr. Clarke received the 2005 John Wesley Powell Award for significant contributions to the advancement of the U.S. Geological Survey mission.



### Dr. MAHESH KUMAR JAT,

Dr. Mahesh is Associate Professor in the Department of Civil Engineering, MNIT Jaipur since 1999. He did his Ph.D from Indian Institute of Technology Roorkee in the area of Integrated Water Management Modelling using Geo-spatial Technologies. He has more than 16 years of teaching and research experience in the area of geo-spatial data collection & analysis technologies, water resources and hydrology. His current research interests are land use/land cover change modelling, climate change impact assessment & adaptation and integrated water management modelling.



## COURSE COORDINATORS:

### Dr. Mahesh Kumar Jat

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## About MNIT Jaipur

The college was established in 1963 with the name as **Malaviya Regional Engineering College, Jaipur** as a joint venture of the Government of India and the Government of

Rajasthan, Subsequently; on June 26, 2002 the college has been given the status of National Institute of Technology and on 15 August 2007, Proclaimed Institute of National Importance through Act of Parliament. The Institute is fully funded by Ministry of Human Resource Development (MHRD), Government of India. More than 12,000 students have already been graduated since its establishment.

### **About Jaipur**

Rajasthan's beautiful Pink City Jaipur, was the stronghold of a clan of rulers whose three hill forts and series of palaces in the city are important attractions. Known as the Pink City because of the colour of the stone used exclusively in the walled city, Jaipur's bazaars sell embroidered leather shoes, blue pottery, tie and dye scarves and other exotic wares. Western Rajasthan itself forms a convenient circuit, in the heart of the Thar desert which has shaped its history, lifestyles and architecture.

#### ***Tourist Interested Places are:***

Jantar Mantar, Amber Fort, Moti Doongari and Lakshmi Narayan Temple, City Palace, Albert Hall (Museum), Hawa Mahal, Jaigarh Fort, Sisodia Rani Garden and many more.....

### **How Reach MNIT Jaipur**

MNIT Jaipur is centrally located in Jaipur City famously known as "Pink City". Jaipur is one of famous tourist destination in India and situated around 250 Km from Delhi. One can reach Jaipur by Air, Train or Bus from different parts of India. Weather is generally pleasant in Jaipur in the Month of July.

*The course is being organized by the Department of Civil Engineering. We look forward to your participation and support in making this conference a success.*

### **Website:**

MNIT Jaipur - [www.mnit.ac.in](http://www.mnit.ac.in)  
MHRD GIAN - [www.gian.iitkgp.ac.in](http://www.gian.iitkgp.ac.in)