

IIT Mandi
Proposal for a New Course

Course Number : EE-591
Course Name : Network Systems and Control
Credits : 1 credit
Prerequisites : EE509 – Linear Dynamical Systems
Intended for : PG/UG
Distribution : Elective for final year undergraduates in EE and ME
Elective for other postgraduates (M.Tech/M.Sc.(Maths)/MS/Ph.D).
Semester : Even semester

1. Preamble:

There is a renewed interest in Network Sciences, with the advent of Internet-of-things, and other complex networks (social, biological, traffic etc.) that are large scale and at the same time safety-critical. Given the scale and complexity of such networks, classical tools may no longer be sufficient for analysis and control purposes. This course will provide an introduction to the tools required for analysis and control of complex networks.

2. Course modules with Quantitative lecture hours:

1. Motivating examples :

Linear and nonlinear Systems - wireless sensor networks, social networks, Lotka-Volterra Population models, coupled oscillator models.

2. Graph and Matrix Theory

The Perron-Frobenius theorem, basics of graph theory

3. Consensus Problems over networks

The graph Laplacian, consensus on Multi-agent systems

4. Virus Propagation models

The SI, SIS, SIR models.

5. Controllability metrics for complex networks

Computational aspects of controlling large networks, selecting best control nodes, control energy.

3. Textbook:

Lecture notes

4. References:

1. Francesco Bullo, Lectures on Network Systems, 2016.

<https://ucsb.app.box.com/v/book-lns>

2. Fabio Pasqualetti, Sandro Zampieri, Francesco Bullo, Controllability Metrics, Limitations and Algorithms for Complex Networks, IEEE Transactions on Control of Network Systems, vol. 1, no. 1, pp. 40–52, 2014.

5. Similarity Content Declaration with Existing Courses: NA

6. Justification for new course proposal if cumulative similarity content is > 30%: NA

Approvals:

Other Faculty interested in teaching this course: Dr. Tushar Jain, Dr. Sreelakshmi PM

Proposed by: Dr. Ramkrishna Pasumathy, IIT Madras
Of EE

School: Dept.

Local Coordinator: Dr. Tushar Jain

School: SCEE

Signature:

Date:

Recommended/Not Recommended, with Comments:

Chairman, CPC

Date:

Approved/Not Approved

Chairman, Senate

Date: