COURSE OUTLINE:
This course ‘Dynamical systems and control’ is a basic course offered to PG students and final year UG students of Engineering/Science background. The objective of this course is to enhance the understanding of the theory, properties and applications of various dynamical and control systems. After completing the course one may be able to understand some of the important aspects of dynamical systems such as mathematical modeling, well posedness (existence, uniqueness and stability) of the considered problem.

ABOUT INSTRUCTOR:
Dr. N. Sukavanam is a Professor in the Department of Mathematics, IIT Roorkee. His area of research includes Control Theory and Robotics. He has supervised nineteen Ph.D. theses and has published more than 80 research papers in reputed international journals. He coordinated five QIP short term courses and a Continuing Education course on Dynamical Systems, Control Theory and Robotics and has delivered many invited lectures on these subjects in many institutions of national importance.

Dr. D. N. Pandey is an Associate Professor in the Department of Mathematics, IIT Roorkee. Before joining IIT Roorkee he worked as a faculty member in BITS-Pilani Goa campus and LNMIIT Jaipur. His area of expertise includes semigroup theory, functional differential equations of fractional and integral orders. He has already prepared e-notes for course titled “Ordinary Differential Equations and Special Functions” under e- Pathshala funded by UGC.

COURSE PLAN:
- **Week 01**: Formulation of Physical System | Existence and uniqueness of solution of a dynamical systems
- **Week 02**: Existence and uniqueness of solution of a dynamical systems | Linear Systems | Solution of linear systems
- **Week 03**: Solution of linear systems | Fundamental Matrix | Fundamental matrices for non-autonomous systems | Solution of non-homogeneous systems.
- **Week 04**: Linear systems with periodic coefficients | Stability of systems, Stability of linear autonomous systems.
- **Week 05**: Stability of weakly non-linear systems | Stability of non-linear systems using linearization | Properties of orbits.
- **Week 06**: Phase Portrait | Limit cycle and periodic solutions | Stability of autonomous systems.
- **Week 07**: Stability of autonomous systems | Stability of non-linear non-autonomous systems | Poincare Bendixon Theorem.
- **Week 08**: Definition of controllability and Observability | Kalman theorem for autonomous systems | Kalman Theorem for non-autonomous system.
- **Week 09**: Duality Theorem | Optimal control | Companion form, Feedback control.
- **Week 10**: Stabilization of linear control systems | Stabilizability using Lyapunov theory.
- **Week 11**: Optimal control of linear system
- **Week 12**: Discrete control systems

TYPE OF COURSE: Rerun | Elective | UG/PG
INTENDED AUDIENCE: All UG/PG students
EXAM DATE: 17 October 2020
COURSE DURATION: 12 weeks (20 Jul’20 - 9 Oct’20)
PRE-REQUISITES: Basic concepts from Linear Algebra and Ordinary Differential Equations

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