Sungkyunkwan University (SKKU) International Summer Semester (ISS)
2018

Differential Equations & Dynamical Systems

Prof. Jun H. Park, Sungkyunkwan University

SHORT COURSE DESCRIPTION

This course focuses on ordinary differential equations (ODEs) with dynamical systems in mind. We learn to model several physical, biological, and social phenomena using ODEs. Topics include: first-order ODEs, second-order ODEs, Laplace transform, systems of ODEs. The main goals of the course are

- Translate simple dynamical systems into first or second order ODEs.
- Solve ODEs using analytical, graphical, and numerical methods.
- Visualize solutions and interpret their physical meaning.

READING MATERIALS

All reading materials will be provided before each class. For those who are interested in the general idea of the topics we study in the course, the following book is recommended:

Boyce & DiPrima, Elementary Differential Equations (2000) John Wiley & Sons

COURSE REQUIREMENTS AND GRADING

This class is pass/fail based on the student academic achievement evaluated by grades on a scale of 100 points (grade of 60 or above is Pass)

Grading Scheme

Attendance	30 points
Assignments	30 points
Final Exam	40 points

Assessment Criteria

Attendance: Students are required to attend at least 80% of all lectures according to SKKU regulations.

Assignments: There will be individual and group assignments which include analytic and numerical problems.

Final Exam: The last class will be 2-hour final exam which tests your comprehension of the material covered in the class.

COURSE SCHEDULE

- WEEK I -

Tuesday (26 June)
Geometric view of ODEs, Numerical methods, Separable ODEs, Modeling.

Wednesday (27 June)
Exact ODEs, Integrating factor, Linear ODEs, Complex numbers.

Thursday (28 June)
Complex exponentials, Sinusoidal functions, Linear system response, Autonomous equations.

Friday (29 June)
Homogeneous linear ODEs, Superposition, spring/mass/dashpot system, Characteristic polynomial.

- WEEK II -

Monday (2 July)
Non-homogeneous linear ODEs: Undetermined coefficients, Variation of parameters.

Tuesday (3 July)
Linear independence, Forced oscillations, Resonance, Undetermined coefficients, Variation of parameters.

Wednesday (4 July)
Forced oscillations, Resonance, Frequency response, Gain and phase lag

Thursday (5 July)
Laplace transform and its application to ODEs: Step, delta function and system response, Convolution

- WEEK III -

Monday (9 July)
Laplace transform and its application to ODEs.

Tuesday (10 July)
Linear systems and matrices. (eigenvalues and eigenvectors)

Wednesday (11 July)
Homogeneous linear system of ODEs: Fundamental matrix

Thursday (12 July)
Phase plane method and Stability

- WEEK IV-

Monday (16 July)
Non-homogeneous linear system of ODEs

Tuesday (17 July)
Quantitative methods for nonlinear systems

Wednesday (18 July)
Final Exam.