

Topics for exam 2, MATH308

1. Chapter 3, sections 3.6-3.8

- Method of variation of parameters for linear non-homogeneous equations of 2nd order (sect. 3.6).
- Spring-mass systems: undamped free vibration (including finding of the amplitude, the period and the natural frequency).
- Spring-mass systems: damped free vibration, including finding of quasi-period and understanding the meaning of critical damping amplitude (the formula for the latter will be given).
The last two items correspond to section 3.7.
- Forced vibration (including finding of steady state solution) (section 3.8).

2. Laplace Transform (Chapter 6). The table of Laplace transform as in the page 317 of the textbook will be given. It is recommended to practice to use this table. You will be asked to solve IVP using Laplace transform. The main points to know for this goal are

- how to transform a given differential equation to an algebraic one using the Laplace transform (section 6.2).
- how to find the inverse Laplace transform of a rational function using the partial fraction decomposition (section 6.2).
- how to find the Laplace transform for a piecewise continuous function (with the help of steps functions, sections 6.3, 6.4) and for an impulse function (section 6.5)
- how to use the convolution for finding inverse Laplace Transform and solution of IVP (section 6.6)

3. Chapter 7, sections 7.1, 7.3-7.6. The main points to know are:

- (a) how to transform a system of differential equations to a matrix form.
- (b) what is a fundamental set of solutions of a first order linear homogeneous system of differential equations and how to check that the given set of solutions is fundamental (section 7.4).
- (c) what are eigenvalues and eigenvectors of a given matrix and how to find them (section 7.3).
- (d) how to solve a system of differential equations and IVP¹ in the following cases:
 - i. distinct real eigenvalues (section 7.5);
 - ii. (distinct) complex eigenvalues (similar to problems 2 and 3 of Homework#9)

Especially pay your attention here on *how on the base of the knowledge of the eigenvalues and eigenvectors to form a fundamental set of solutions and to write the general solution.*

It is *recommended to review all problems in homework assignments 5-9* (except of problem 4b (homework #5) and problems 1 and 4 (homework #9)), *the examples given during the class on the topics listed above and to attempt the additional suggested problems listed in the Class Announcements (the additional suggested problems for the topics covered by homework 7-9 are listed in the Announcement of Friday, April 13.)*

¹especially in the case $n = 3$ you have to practice the Gauss elimination method.