

MATH 302 – TAKE HOME EXAM 3D (Chapters 5, 7, 8)**Summer 2018****150 Points****Directions/Comments:**

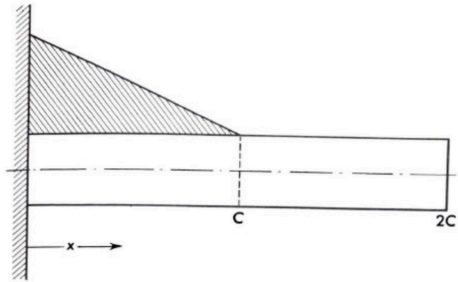
- (1) Put your name below.
- (2) You need to show work/justification to receive full credit
- (3) Answers with no work may receive little or no credit (unless indicated otherwise)
- (4) You may use a scientific calculator for simple algebra operations (addition, multiplication, division, subtraction) only. Leave all answers in fraction form (if applicable) not decimal form.
- (5) You may use your textbook. However, skipping steps and not justifying steps will result in loss of points.
- (6) I must be able to follow your work and logic otherwise, a loss of points could result.
- (7) This is a take home test. Therefore, you may use your textbook, lecture notes, and homework solutions. You may NOT use the internet nor collaborate with any other student, teacher, tutor, etc. This is to be your OWN work. Cheating is considered to be any representation of work that is not your own to include copy solutions and making slight changes to them.

**** Good Luck ****

Name: _____

[1] (10 points) A 100-g mass is attached to one end of a spring. The other end of the spring is attached to the ceiling and the resulting system is allowed to come to rest at its equilibrium position. The length of the spring is measured and found to have increased 10 cm. The mass is pulled down 4 cm below its equilibrium position and released without imparting any velocity. The damping force equals $3500 (dx/dt)$ g-cm/s². Find the equation of motion for this system. State the type of damping motion.

[2] (10 points) Find the displacement x throughout the beam in which the load is assumed to decrease uniformly and is given by the function $W(x)$. The weight of the beam is to be negligible. The beam is embedded at $x = 0$ and simply supported at $x = 2c$.



$$W(x) = \begin{cases} \frac{w_0}{c}(c-x) & 0 \leq x \leq c \\ 0 & c < x \leq 2c \end{cases}$$

[3] (10 points) Find the general solution. State the eigenvalues and eigenvectors.

$$y_1' = -36y_1 - 6y_2 \quad y_2' = 6y_1 - y_2$$

[4] (10 points) Use the Laplace transform to solve the initial value problem.

$$y'' + 3y' + 2y = r(t) \quad r(t) = \begin{cases} 0 & 0 \leq t < 1 \\ 3t^2 & t > 1 \end{cases} \quad y(0) = 0, y'(0) = 0$$

[5] (10 points) Consider an RLC circuit with $R=100\Omega$, $L=1H$, $C=1\times 10^{-4}F$, and a battery supply $E_0 = 90V$. Initially there is no current in the circuit and no charge on the capacitor. At time $t = 0$ the switch is closed and left closed for one second. At time $t = 1$ it is open and left open thereafter. Find the resulting current in the circuit. (Hint: this should be an integrodifferential equation)