University of Notre Dame
Aerospace and Mechanical Engineering

AME 302: Differential Equations, Vibrations and Controls
Exam 1

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NAME: _____

- You have 50 minutes to complete this exam.
- This is an open book exam. You may consult the course text, your class notes, your own homework sets and any documents provided on the course homepage such as homework solutions, *etc.* You may **not** use a calculator.
- There are four questions. Each question is worth 25 points.
- Your grade on this exam will constitute 20% of your total grade for the course. *Show your work* if you want to receive partial credit for any problem.
- Answer each question in the space provided on each page or on the blank pages. If you need more space, use the back of the pages or use additional sheets of paper as necessary.
- Do not start or turn the page until instructed to do so.

The move from a structuralist account in which capital is understood to structure social relations in relatively homologous ways to a view of hegemony in which power relations are subject to repetition, convergence, and rearticulation brought the question of temporality into the thinking of structure, and marked a shift from a form of Althusserian theory that takes structural totalities as theoretical objects to one in which the insights into the contingent possibility of structure inaugurate a renewed conception of hegemony as bound up with the contingent sites and strategies of the rearticulation of power.

Judith Butler, "Further Reflections on the Conversations of Our Time," Diacritics (1997).

1. Find the general solution to

$$\dot{\xi} = A\xi,$$

where

$$A = \begin{bmatrix} 3 & -2 \\ 4 & -4 \end{bmatrix}.$$

(25 points)

Intentionally left blank.

2. Solve

$$\dot{\xi} = A\xi,$$

where

$$A = \begin{bmatrix} 1 & 4 \\ -5 & -1 \end{bmatrix}$$

and

$$\xi(0) = \begin{bmatrix} 1 \\ \frac{1}{4} \end{bmatrix}.$$

(25 points)

Intentionally left blank.

3. Solve

$$\dot{\xi} = A\xi,$$

where

$$A = \begin{bmatrix} 2 & -\frac{1}{2} \\ \frac{1}{2} & 1 \end{bmatrix}$$

and

$$\xi(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}.$$

(25 points)

Intentionally left blank.

4. Consider

$$A = \begin{bmatrix} 1 & 8 & 0 & 0 \\ 0 & 5 & 10 & 0 \\ 0 & 2 & 6 & 12 \\ 0 & 0 & 0 & 20 \end{bmatrix}$$

and

$$\xi = \begin{bmatrix} 8 \\ 9 \\ \frac{9}{2} \\ 0 \end{bmatrix}.$$

Is ξ an eigenvector of A? If so, what is the corresponding eigenvalue? If not, show that it is not. (25 points)

Intentionally left blank.