



Full Name : _____ Student ID: _____

Grade Table (for Lecturer use only)

Question	Points	Score
1	10	
2	15	
3	25	
4	25	
5	25	
Total:	100	

Instructions for Final Exam

Welcome to the final exam of EEE225 - Engineering Mathematics I and good luck!

Please read the following rules and confirm by signing that you have read and understood the rules before you receive your exam:

- The final exam shall be conducted between 13:15 and 15:15. Exam duration is 120 minutes. Students must finalise the exam by delivering it before 15:15. Students are not allowed to leave the exam in the first 30 minutes.
- Student ID cards shall visibly be on the edge of desks till the end of the exam. Students without the student ID cards or Turkish identity cards shall not be participated into the exam.
- This is a closed-book exam which means that students are not allowed to take notes, books, or any other reference material into the exam. Throughout the exam, students shall not possess mobile phones and electronic devices that are capable of storing, receiving or transmitting information or electronic signals, such as computerised watches.
- Students are not allowed to take a glance at the exam questions until told to do so. Students shall not communicate with any other student under any circumstances during the exam period. A student, who cheats, tries to cheat during the exam, or is identified to be cheating after investigating exam documents, is given 0 (zero) for that exam and a disciplinary investigation is opened against the student.
- An incorrect answer to a question is awarded no marks with no consideration of any partial credit. Therefore, no partial credit will be given.

In recognition of and in the spirit of the above rules which constitute Adana Alparslan Türker Science and Technology University Honour Code, I certify that I will neither give nor receive unpermitted aid on this examination.

Signature: _____



1. (10 points) The linear second-order partial differential equation

$$A \frac{\partial^2 u}{\partial x^2} + B \frac{\partial^2 u}{\partial x \partial y} + C \frac{\partial^2 u}{\partial y^2} + D \frac{\partial u}{\partial x} + E \frac{\partial u}{\partial y} + Fu = G$$

where A, B, C, D, E, F, and G are real constants, is said to be

-if $B^2 - 4AC < 0$,
-if $B^2 - 4AC = 0$,
-if $B^2 - 4AC > 0$.

2. (15 points) Using the Laplace transform, solve the first-order ODE

$$\frac{dy}{dt} + 2y = 0, \quad y(0) = 5$$

Answer: _____



3. (25 points) Determine the output $y(t)$ of an underdamped second-order system with the nonrepeating square-wave input $w(t)$ shown in Figure 1.

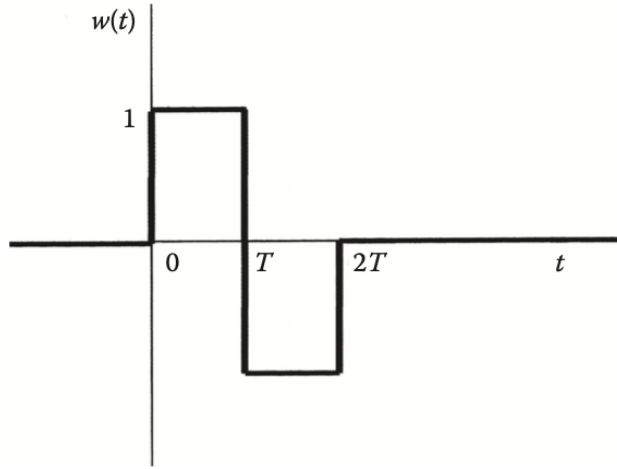


Figure 1: Nonrepeating square-wave

Answer: _____



4. (25 points) Solve

$$\frac{dx}{dt} = \underline{A}x$$

where

$$\underline{x}(0) = \begin{pmatrix} v_s \\ 0 \\ 0 \end{pmatrix}$$

and

$$\underline{A} = \frac{-1}{4RC} \begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{pmatrix}$$

Answer: _____



5. (25 points) Find the steady-state solution to

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} 1 & -1 \\ 3 & -2 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \end{pmatrix} t \sin 2t$$

Hint: The above equation is of the form $\dot{\underline{x}} = \underline{A}\underline{x} + \underline{b}t \sin \omega t$. Therefore, the students are advised to try the solution $\underline{x}(t) = (\underline{c}t + \underline{d}) \sin \omega t + (\underline{e}t + \underline{f}) \cos \omega t$ according to the matrix undetermined coefficients method.

Answer: _____