

**Institute of Applied Mechanics and Mechatronics
Faculty of Mechanical Engineering STU in
Bratislava**

ASSIGNMENT 1

**LAPALCE TRANSFORM AND RESPONSE OF THE
SYSTEM**

NAME AND SURNAME:

GROUP:

ASSIGNEMENT 1

TASK:

Consider the **differential equation** according your variant and solve it using the methods of Laplace transform.

Find the general solution **y(t)** of the given differential equation with respect of time considering the **initial conditions** and **forcing function u(t)** according the specification of your variant.

Solution of the response of DR and diagram of the forcing input function display on figure. During solution is possible to use Matlab function and correspondent vocabulary of Laplace functions.

Variants

1. $3\ddot{y}(t) + 21\dot{y}(t) + 42y(t) = 3u(t)$, $\ddot{y}(0) = 2$, $\dot{y}(0) = y(0) = -1$, kde $u(t) = 2$
2. $12\ddot{y}(t) + 45\dot{y}(t) + 10y(t) = u(t)$, $\dot{y}(0) = -2$, $y(0) = 0$, kde $u(t) = 3$
3. $\ddot{y}(t) + 2\dot{y}(t) - 4y(t) + 8y(t) = u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = \sin(3t)$
4. $2\ddot{y}(t) + 12\dot{y}(t) + 18y(t) = 4u(t)$, $\ddot{y}(0) = -1$, $\dot{y}(0) = 0$, $y(0) = -2$, kde $u(t) = \cos(6t)$
5. $\ddot{y}(t) + 15\dot{y}(t) + 10y(t) - 5y(t) = 10u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = t$
6. $-\ddot{y}(t) + 9\dot{y}(t) + 12y(t) - 18y(t) = -u(t)$, $\ddot{y}(0) = -3$, $\dot{y}(0) = -2$, $y(0) = 0$, kde $u(t) = 5$
7. $\ddot{y}(t) + 21\dot{y}(t) + 42y(t) + 24y(t) = u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = \sin(2t) + \cos(3t)$
8. $4\ddot{y}(t) + 16\dot{y}(t) + 16y(t) = 4u(t)$, $\dot{y}(0) = y(0) = 0$, kde $u(t) = te^{-4t}$
9. $3\ddot{y}(t) + 9\dot{y}(t) + 18y(t) = 3u(t)$, $\dot{y}(0) = y(0) = -1$, kde $u(t) = te^{-2t}$
10. $0.5\ddot{y}(t) + \dot{y}(t) + 8y(t) + 16y(t) = 0.5u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = -1$, kde $u(t) = 2$
11. $30\ddot{y}(t) + 15\dot{y}(t) + 300y(t) + 30y(t) = 30u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = -2$, kde $u(t) = 3t$
12. $\ddot{y}(t) + 15\dot{y}(t) + 24y(t) + 12y(t) = 3u(t)$, $\ddot{y}(0) = -1$, $\dot{y}(0) = y(0) = 2$, kde $u(t) = 4$
13. $\ddot{y}(t) + 15\dot{y}(t) + 42y(t) + 24y(t) = 3u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = 4t$
14. $4\ddot{y}(t) + 16\dot{y}(t) + 16y(t) = 4u(t)$, $\dot{y}(0) = y(0) = 0$, kde $u(t) = 3\cos(2t)$
15. $\ddot{y}(t) + 16\dot{y}(t) + 16y(t) = 4u(t)$, $\dot{y}(0) = -2$, $y(0) = 5$, kde $u(t) = 8t$

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16. $8\ddot{y}(t) + 16\dot{y}(t) + 16y(t) = 8u(t)$, $\dot{y}(0) = y(0) = -1$, kde $u(t) = \sin(2t)$

17. $\ddot{y}(t) - 21\dot{y}(t) + 42y(t) - 18y(t) = 3u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = te^{-4t}$

18. $5\ddot{y}(t) - 25\dot{y}(t) + 5y(t) - 15y(t) = 20u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = 3\sin(5t)$

19. $2\ddot{y}(t) - 16\dot{y}(t) + 8y(t) = 2u(t)$, $\dot{y}(0) = -3, y(0) = -1$, kde $u(t) = 2$

20. $\ddot{y}(t) - 4\dot{y}(t) + 80y(t) + 100y(t) = 10u(t)$, $\ddot{y}(0) = 1, \dot{y}(0) = -2, y(0) = 0$, kde $u(t) = 6t$

21. $0.5\ddot{y}(t) + 20\dot{y}(t) + 16y(t) = 0.5u(t)$, $\dot{y}(0) = y(0) = -2$, kde $u(t) = 5$

22. $0.25\ddot{y}(t) + 16\dot{y}(t) + 108y(t) + 10y(t) = 0.25u(t)$, $\ddot{y}(0) = 1, \dot{y}(0) = -2, y(0) = 2$, kde
 $u(t) = 2t$

23. $3\ddot{y}(t) + 18\dot{y}(t) + 27y(t) = 3u(t)$, $\dot{y}(0) = y(0) = 0$, kde $u(t) = te^{-2t}$

24. $3\ddot{y}(t) - 27y(t) = 3u(t)$, $\dot{y}(0) = -1, y(0) = 2$, kde $u(t) = 4\cos(2t)$

25. $4\ddot{y}(t) + 18\dot{y}(t) = -4u(t)$, $\dot{y}(0) = 3, y(0) = -1$, kde $u(t) = te^{-3t}$

26. $\ddot{y}(t) - 15\dot{y}(t) + 80y(t) = 3u(t)$, $\ddot{y}(0) = 1, \dot{y}(0) = 2, y(0) = -5$, kde $u(t) = 1$

27. $-3\ddot{y}(t) + 21\dot{y}(t) - 15y(t) + 30y(t) = 3u(t)$, $\ddot{y}(0) = -1, \dot{y}(0) = -5, y(0) = 10$, kde
 $u(t) = 20$

28. $5\ddot{y}(t) + 25\dot{y}(t) + 125y(t) = 20u(t)$, $\ddot{y}(0) = -1, \dot{y}(0) = -5, y(0) = 10$, kde $u(t) = 5$

29. $-\ddot{y}(t) + 12\dot{y}(t) + 16y(t) + 24y(t) = -3u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = \sin(3t)$

30. $\ddot{y}(t) + 3\dot{y}(t) - 2y(t) + 10y(t) = 6u(t)$, $\ddot{y}(0) = -2, \dot{y}(0) = 2, y(0) = 4$, kde $u(t) = 10$

31. $3\ddot{y}(t) + 9\dot{y}(t) - 3y(t) + 18y(t) = 3u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = 4te^{-4t}$

32. $\ddot{y}(t) + 18\dot{y}(t) + 27y(t) = 2u(t)$, $\dot{y}(0) = -5, y(0) = 10$, kde $u(t) = 3$

33. $\ddot{y}(t) - 5\dot{y}(t) + 20y(t) + 100y(t) = 5u(t)$, $\ddot{y}(0) = \dot{y}(0) = y(0) = 0$, kde $u(t) = \sin(9t)$

34. $\ddot{y}(t) - 18\dot{y}(t) + 27y(t) = 3u(t)$, $\dot{y}(0) = 2, y(0) = 10$, kde $u(t) = 20$