# Differential Equations and Transforms (BMAT102L)
## (Winter Semester 2021-2022)

### Tutorial Sheet- I

1. Find the general solution of following differential equations:

   (i) $y'' + 5y' + 6y = 0$, (ii) $y'' + 6y' + 9y = 0$, (iii) $y'' - 6y' + 13y = 0$.

2. Solve the following initial value problems:

   (i) $y'' - 4y = 0, y(0) = 0, y'(0) = 1$,
   (ii) $y'' - 2y' + 2y = 0$, $y(0) = 0, y'(0) = 1$.

3. Find the general solution of the following differential equations using method of undetermined coefficients:

   (i) $y'' + 2y' + y = 5\sin x$,
   (ii) $2y'' - 5y = x^2 + 5e^{-4x}$,
   (iii) $y'' + 4y = \sin 5x + x - 1$,
   (iv) $y'' - y = 2\sin x + 2$,
   (v) $y'' + 2y' + 2y = e^x \cos 2x$.

4. Find the general solution of the following differential equations using method of undetermined coefficients:

   (i) $y'' - 7y' + 10y = 20e^{5x} - 10$,
   (ii) $y'' - 2y' = x^2 + 5x - 2$,
   (iii) $y'' + 9y' + 14y = 20 + e^{2x} + e^{-2x}$,
   (iv) $y'' - 2y' + y = e^x + x^2$,
   (v) $y'' - y' = \cos x + 5$.

5. Find the general solution of the following differential equations using method of undetermined coefficients:

   (i) $y'' - 2y' + y = x^2 e^{5x}$,
   (ii) $y'' - 2y' + y = 20e^x \sin x$,
   (iii) $y'' - 2y' + y = x \sin x$.

6. Solve the following initial value problems using method of undetermined coefficients:

   (i) $y'' - 9y = e^x + x - 1$, $y(0) = -1, y'(0) = 1$,
   (ii) $y'' + y = 5x \sin x$, $y(0) = 0, y'(0) = 1$.

7. Use variation of parameters method to find the general solution of the following differential equations:

(i) $y'' + 16y = 32 \sec 2x$,

(ii) $y'' + 4y' + 4y = e^{-2x} \sin x$,

*Doubt*

8. Use variation of parameters method to find the general solution of the following differential equations:

(i) $y'' - 4y' + 3y = e^x$,

(ii) $y'' - 2y' + y = \dfrac{e^x}{x^2 + 1}$,

9. Use variation of parameter methods to find the particular solution of $xy'' - (x+1)y' + y = x^2$, given that $y_1(x) = e^x$ and $y_2(x) = x + 1$ form a fundamental set of solutions for the corresponding homogeneous differential equation.

10. Solve the following IVP (initial value problem):

$$y'' - 4y' - 12y = 3e^{5x}, \quad y(0) = \frac{18}{7}, \ y'(0) = \frac{-1}{7}.$$