Sample subjects for MATLAB laboratory colloquium SS2

Subject Model 1:
1. Using symbolic computation in MATLAB, determine the Laplace transform for the signal:
$$x(t) = \begin{cases} t^3 e^{-2t}, t \geq 0 \\ 0, \hat{\imath}n\ rest \end{cases}$$

2. Using symbolic computation in MATLAB, determine the inverse Laplace transform for the signal:
$$X(s) = \frac{1 - e^{-2s}}{s(s+1)}$$

This subject should be solved in MATLAB. After obtaining the result in MATLAB, write down the obtained results on the exam sheet.
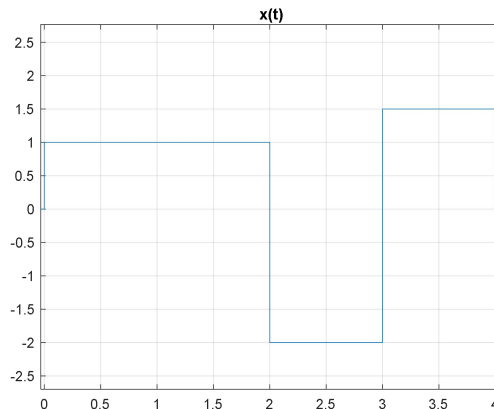

Subject Model 2:

Using MATLAB, determine the poles and residues, as well as the inverse Laplace transform for the signal:
$$X(s) = \frac{4s - 8}{s^3 + 2s^2 + s}$$

The solution to this subject must be done in MATLAB. After obtaining the results in MATLAB, write down the poles, residues, and inverse Laplace transform obtained on the exam sheet.

Subject Model 3:
Using symbolic computation in MATLAB, determine the Laplace transform for the signal defined in the following figure, defined over the time interval $0 \leq t \leq 4$:

The solution to this subject must be done in MATLAB. After obtaining the result in MATLAB, write down the obtained signal and inverse Laplace transform on the exam sheet.

Subject Model 4:
Using MATLAB, generate and graphically represent the following discrete signal:
$$x[n] = 0.2 \cdot \delta[n-1] + \delta[n-3] - 0.6 \cdot \delta[n+4], \text{ for } -5 \leq n \leq 10$$
The abscissa (n) must cover only the indicated domain.

Subject Model 5:
Using MATLAB, generate and graphically represent a discrete sinusoidal signal with amplitude, containing 14 samples per period. The abscissa domain must cover only the interval.
The solution to this subject must be done in MATLAB. After obtaining the result in MATLAB, write down on the exam sheet how many periods are displayed on the screen.

Subject Model 6:
Using MATLAB, generate and graphically represent a periodic impulse train with amplitude $A_l = 1.5V$, period $P = 4$, and pulse width $M \cdot P = 20$:

$$x[n] = \sum_{l=0}^{M-1} A_l \delta[n - lP]$$

The domain of the abscissa must cover only the interval $0 \leq n \leq M \cdot P$.

Subject Model 7:
  a. Using MATLAB, generate the discrete sequence $x[n]$ obtained from the signal $x(t) = \cos(2\pi F_1 t)$ with frequency $F_1 = 2.5kHz$ and duration $t_{max} = 100ms$, by sampling it with frequency $F_s = 8kHz$.
  b. Calculate the Two-Sided Fourier Transform (TFTD) of the signal $x[n]$ in $N = 64$ points and represent the amplitude spectrum of the TFTD in non-normalized frequencies $F \in [0, Fs)$ using the fft() function.

Subject Model 8:
  a. Using MATLAB, generate the discrete sequence $x[n]$ obtained from the signal $x(t) = \cos(2\pi F_1 t)$ with frequency $F_1 = 4kHz$ and duration $t_{max} = 100ms$, by sampling it with frequency $F_s = 10kHz$.
  b. Calculate the Two-Sided Fourier Transform (TFTD) of the signal $x[n]$ in $N = 64$ points and represent the amplitude spectrum of the TFTD in non-normalized frequencies $F \in [-\frac{Fs}{2}, \frac{Fs}{2})$ using the fft() function.