Please show all your working. Please write your answers in full detail. There is not enough space on the question sheet for your answers. Keep the question sheet for later discussions.

1. (6 points) Find the Laplace transform of the periodic function given by

$$
f(t)=t, \quad 0 \leq t<2 \quad \text { and } f(t) \text { has period } 2
$$

2. (6 points) Let $\mathcal{L}\{y(t)\}(s)=Y(s)$. Show that

$$
\mathcal{L}\left\{t^{2} y^{\prime}(t)\right\}(s)=s Y^{\prime \prime}(s)+2 Y^{\prime}(s)
$$

Be sure to explain clearly which general properties of the Laplace transform you use.
3. (6 points) Determine The inverse Laplace transform of $F(s)$ given that

$$
s F(s)+2 F(s)=\frac{10 s^{2}+12 s+14}{s^{2}-2 s+2}
$$

4. (7 points) Solve the initial value problem using Laplace transforms.

$$
y^{\prime \prime}+2 y^{\prime}+2 y=u(t-2 \pi)-u(t-4 \pi) ; \quad y(0)=1, y^{\prime}(0)=1
$$

