The solutions are presented here.
If the steps are proper and answer matches well with the provided solutions, you get full marks. otherwise, marks have been deducted according to your mistakes.

ENEL441 QUIZ 1 Jan 29, 2020 Laplace transform and transfer functions

Name________________________ UCID________________________

35 minutes, 20 marks total

1.(5) Find the Laplace transform of the following function

$$f(t) = tu(t-2) + 3\delta(t) + u(t-3)\exp(t-3)$$

Sol 1 note $\exp(t)\exp(-3)$ grows exponentially with t. Hence $F(s)$ does not exist,

Sol 2 Ignore this and get incorrect answer but if you solved it, get full marks.

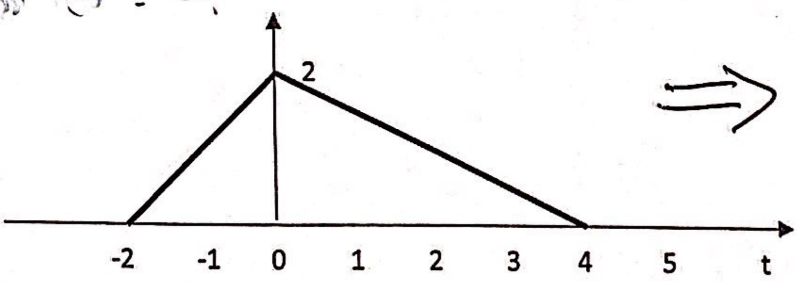
$$tu(t-2) = (t-2+2)u(t-2) = (t-2)u(t-2) + 2u(t-2)$$

$$\Rightarrow e^{-2s}/s^2 + 2e^{-2s}/s$$

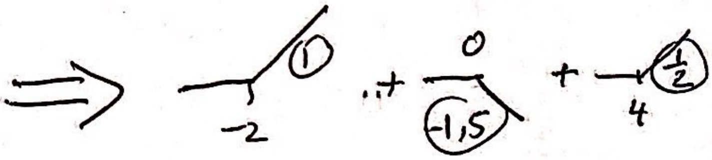
$$F(s) = \frac{e^{-2s}}{s^2} + \frac{2e^{-2s}}{s} + 3 + \frac{e^{-3s}}{s-1}$$

OK for 5 marks but not correct

2.(5) A function f(t) is shown in the figure. Assume that f(t)=0 for t<-2 and for t>4.



$\Rightarrow$



a. (3) Write an expression for f(t) in terms of elemental functions.

$$f(t) = (t+2)u(t+2) - 1.5\,t\,u(t) + \frac{1}{2}(t-4)u(t-4)$$

b.(2) Find the Laplace transform of f(t)

$$F(s) = \frac{e^{2s}}{s^{2}} - \frac{1{,}5}{s^{2}} + \frac{1}{2}\frac{e^{-4s}}{s^{2}}$$

3.(5) Determine the inverse Laplace transform of

$$F(s) = \frac{e^{-s}}{(s+1)(s+2)}$$

$$F(s) = e^{-s}\left(\frac{1}{s+1} - \frac{1}{s+2}\right)$$

$$f(t) = u(t-1)\,e^{-(t-1)} - u(t-1)\,e^{-2(t-1)}$$

4.(5) An LTI system is described by the following DEQ

$$3\frac{d^3y}{dt^3} + x + \frac{dx}{dt} = 0$$

where x(t) is the independent input excitation and y(t) is the output response. Determine Y(s) for the excitation of x(t)=u(t). Assume all the initial conditions are zero. Then solve for y(t).

no IC's so converting to Laplace

$$3s^3 Y(s) + X(s)(1+s) = 0$$

$$Y(s) = -\frac{(1+s)}{3s^3} X(s)$$

$$X(s) = \frac{1}{s}$$

$$Y(s) = -\frac{1}{3s^4} - \frac{1}{3s^3}$$

$$y(t) = -\frac{1}{18} t^3 u(t) - \frac{1}{6} t^2 u(t)$$