

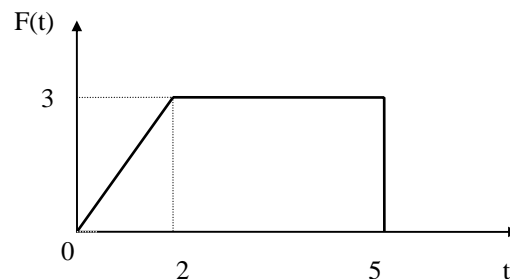
**King Saud University**  
**College of Engineering**  
**Chemical Engineering Dept.**

**CHE323- Exam 1 (1<sup>st</sup> term 1418/1419)**

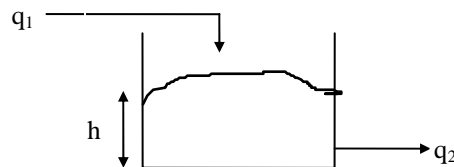
**Q1(8pts)** Using the definition of Laplace transforms find the Laplace transform of:

$$f(t) = e^{-bt} \sin wt$$

**Q2(8pts)** Calculate the Laplace transform of the graphical input signal in the accompanying figure. Check your solution using the initial and final value theorem



**Q3(10pts)** The storage tank shown below has a cross sectional area of  $1 \text{ m}^2$  and a normal (steady state) level of  $1.44 \text{ m}$  when the inflow and outflow are  $2.4 \times 10^{-3} \text{ m}^3/\text{s}$ . Consider the outflow can be related to the level as  $q_2 = k h^{0.5}$ . If the inflow is increased suddenly to  $3.0 \times 10^{-3} \text{ m}^3/\text{s}$ , determine the new steady state value of the level in the tank using the non-linear model and the linearized model.



**Q4(4pts)** In the attached figure a plant-wide control structure is given. Determine the number of feedback control loops and for each loop determine the controlled output and the corresponding manipulated variable.