SÜLEYMAN DEMİREL ÜNİVERSİTESİ
MÜHENDİSLİK-MİMARLIK FAKÜLTESİ
MAKİNE MÜHENDİSLİĞİ BÖLÜMÜ

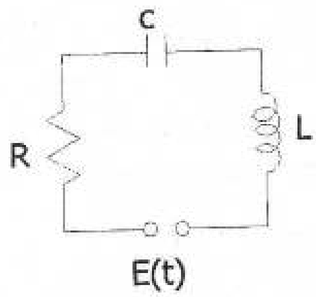
DERS ADI	: Mühendislik Matematiği II	ÖĞRENCİ ADI	....
DERS KODU	: 101400206-102900206	ÖĞRENCİ NO	....
Uygun olanı çerçeve içine alınız. I. Öğretim / II. Öğretim	A Şubesi / B Şubesi	TARİH : 04 / 06 / 2010	İMZA : ....

SORU	1	2	3	4	TOPLAM
ALINAN PUAN					

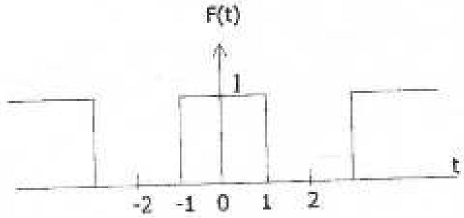
SORULAR

S.1. (25P) $\dfrac{d^2y}{dt^2}+y=1-e^{-t}$, $y(0)=y'(0)=0$ başlangıç değer problemini Laplace dönüşümü yardımıyla çözünüz?

S.2. (25P) Şekilde gösterilen RLC devresinde I(t) akımını bulunuz? Burada R=4 ohm, L=1 henry, C=0.25 farad E(t)=t^2'dir. Başlangıçta akım ve yük sıfırdır.



S.3. (25P) Yandaki şekilde verilen grafiğin Fourier serisine açılımını bulunuz.



S.4. (25P) $2y=x^2-4x$ parabolü ile y=x doğrusu arasında kalan bölgenin grafiğini çizerek, alanını bulunuz.

<u>Dersin sorumlusu</u>: Prof. Dr. Osman İPEK - Ümran ESENDEMİR - Ayşe ÖNDÜRÜCÜ

<u>Sınav Süresi</u>: 90 dakika

$f(t)=L^{-1}\{F(s)\}$	$F(s)=L\{f(t)\}$
1	$\dfrac{1}{s}$
e^{at}	$\dfrac{1}{s-a}$
Sin(at)	$\dfrac{a}{s^2+a^2}$
Cos(at)	$\dfrac{s}{s^2+a^2}$

$f(t)=L^{-1}\{F(s)\}$	$F(s)=L\{f(t)\}$
$e^{at}\sin bt$	$\dfrac{b}{[(s-a)^2+b^2]}$
$e^{at}\cos bt$	$\dfrac{s-a}{[(s-a)^2+b^2]}$
t^n , (n=1,2,3,.....)	$\left(\dfrac{n!}{s^{n+1}}\right)$

CEVAPLAR

(1) $\dfrac{d^2y}{dt^2} + y = 1 - e^{-t}$ $\qquad y(0) = y'(0) = 0$

$$s^2Y(s) - sy(0) - y'(0) + Y(s) = \frac{1}{s}_{(s+1)} - \frac{1}{s+1}_{s}$$

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

$$\boxed{Y(s) = \frac{1}{s(s+1)(s^2+1)}}$$

$$1 = \frac{A}{s} + \frac{B}{s+1} + \frac{Cs+D}{s^2+1}$$ paydalar eşitlenirse

$$1 \equiv As^3 + As + As^2 + A + Bs^3 + Bs + Cs^3 + Cs^2 + Ds^2 + Ds$$

$$\left.\begin{aligned} A+B+C &= 0 \\ A+C+D &= 0 \\ A+B+D &= 0 \\ A &= 1 \end{aligned}\right\} \qquad \begin{aligned} A &= 1 \\ B &= -\frac{1}{2} \\ C &= -\frac{1}{2} \\ D &= -\frac{1}{2} \end{aligned}$$

$$y(t) = 1 \cdot L^{-1}\left\{\frac{1}{s}\right\} - \frac{1}{2}L^{-1}\left\{\frac{1}{s+1}\right\} - \frac{1}{2}L^{-1}\left\{\frac{s}{s^2+1}\right\} - \frac{1}{2}L^{-1}\left\{\frac{1}{s^2+1}\right\}$$

$$\boxed{y(t) = 1 - \frac{1}{2}e^{-t} - \frac{1}{2}\cos t - \frac{1}{2}\sin t}$$

② $L\dfrac{d^2I}{dt^2} + R\dfrac{dI}{dt} + \dfrac{I}{C} = \dot{E}(t) = \dfrac{dE}{dt}$

$$1 . \frac{d^2I}{dt^2} + 4\frac{dI}{dt} + \frac{I}{0{,}25} = 2t$$

$$s^2 I(s) - s I(0) - I'(0) + 4s I(s) - I(0) + 4I(s) = \frac{2}{s^2}$$

$$I(s)\,(s^2+4s+4) = \frac{2}{s^2}$$

$$\boxed{I(s) = \frac{2}{s^2(s+2)^2}}$$

$$\frac{2}{s^2(s+2)^2} = \underset{(s+2)^2}{\frac{A}{s^2}} + \underset{s(s+2)^2}{\frac{B}{s}} + \underset{s^2}{\frac{C}{(s+2)^2}} + \underset{s^2(s+2)}{\frac{D}{s+2}}$$

$$As^2 + 4As + 4A + Bs^3 + 4Bs^2 + 4Bs + Cs^2 + Ds^3 + 2Ds^2 = 2$$

$$\left.\begin{array}{l} B + D = 0 \Rightarrow B = -D \\ A + 4B + C + 2D = 0 \\ 4A + 4B = 0 \Rightarrow 4A = -4B \\ 4A = 2 \Rightarrow A = \frac{1}{2} \end{array}\right\} \quad \boxed{A = \frac{1}{2}} \quad \boxed{B = -\frac{1}{2}} \quad \boxed{D = \frac{1}{2}} \quad \boxed{C = \frac{1}{2}}$$

$$L^{2}\{I(s)\} = I(t) = \frac{1}{2}L^{-1}\left\{\frac{1}{s^2}\right\} - \frac{1}{2}L^{-1}\left\{\frac{1}{s}\right\} + \frac{1}{2}L^{-1}\left\{\frac{1}{(s+2)^2}\right\} + \frac{1}{2}L^{-1}\left\{\frac{1}{s+2}\right\}$$

$$\boxed{I(t) = \frac{1}{2}t - \frac{1}{2} + \frac{1}{2}te^{-2t} + \frac{1}{2}e^{-2t}}$$

C.3. Çift fonksiyon

$$b_n = 0, \quad a_0 = \frac{2}{L}\int_0^L f(x)\,dx, \quad a_n = \frac{2}{L}\int_0^L f(x)\cos\frac{n\pi x}{L}\,dx$$

$$a_0 = \frac{2}{2}\int_0^2 f(x)\,dx = \int_0^1 1\,dx + \int_1^2 0\,dx$$

$$a_0 = x\Big|_0^1 \Rightarrow \boxed{a_0 = 1}$$

$$a_n = \frac{2}{2}\int_0^2 f(x)\cos\frac{n\pi x}{L}\,dx$$

$$= \int_0^1 \cos\frac{n\pi x}{2}\,dx + \int_1^2 0.\cos\frac{n\pi x}{2}\,dx$$

$$= \frac{2}{n\pi}\sin\frac{n\pi x}{2}\Big|_0^1 \Rightarrow a_n = \frac{2}{n\pi}\left(\sin\frac{n\pi}{2} - 0\right)$$

$$\boxed{a_n = \frac{2}{n\pi}\sin\frac{n\pi}{2}}$$

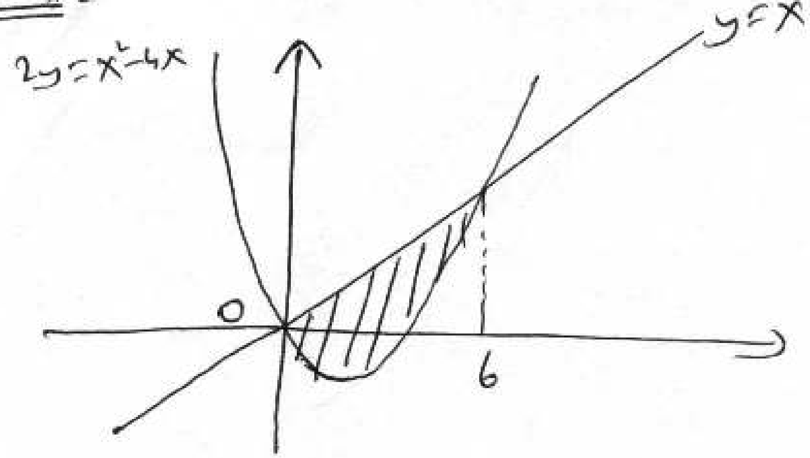
$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n\cos\frac{n\pi x}{L} + b_n\sin\frac{n\pi x}{L}$$

$$f(x) = \frac{1}{2} + \frac{2}{\pi}\sin\frac{\pi}{2}\cos\frac{\pi x}{2} + \frac{2}{2\pi}\sin\pi\cos\frac{2\pi x}{2}$$

$$+ \frac{2}{3\pi}\sin\frac{3\pi}{2}\cdot\cos\frac{3\pi x}{2} + \frac{2}{4\pi}\sin\frac{4\pi}{2}\cos\frac{4\pi x}{2}$$

$$+ \ldots$$

S-4.



$$A=\int_0^6\int_{\frac{1}{2}(x^2-4x)}^{x} dy\,dx = \int_0^6 y\Big|_{\frac{x^2}{2}-2x}^{x} dx$$

$$= \int_0^6 \left(x-\frac{x^2}{2}+2x\right)dx = \int_0^6 \left(3x-\frac{x^2}{2}\right)dx$$

$$A=\left(\frac{3}{2}x^2-\frac{x^3}{6}\right)\Big|_0^6 = 54-36 = 18 \text{ birim kare}$$