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# PES University, Bengaluru

(Established under Karnataka Act No. 16 of 2013)

UE16EC204/UE15EC252

## END SEMESTER ASSESSMENT B.TECH. 3rd SEMESTER - Dec-2017

## UE16EC204/UE15EC252 - SIGNALS AND SYSTEMS

***Note:1. Standard Notations are used.***

***2. Assume Missing data suitably.***

***3. Figures are not drawn to scale but only approximate sketch is given.***

Time: 3 Hrs | Answer All Questions | Max Marks: 100

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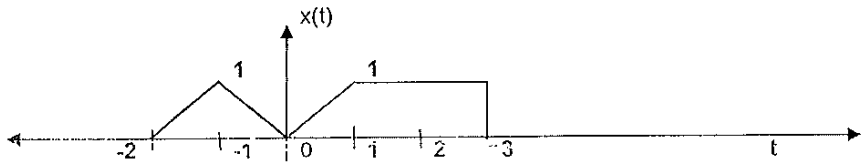
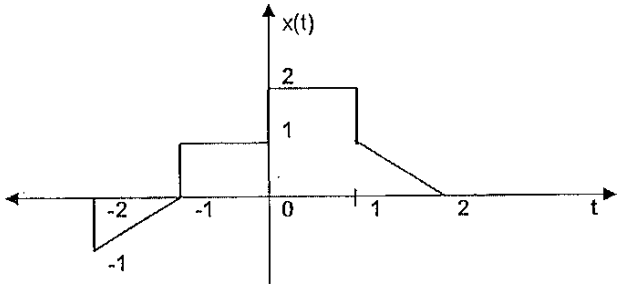
| 1.a | Determine the Energy and Power for the following signals<br>(i) $x(t) = e^{-2t}u(t-1)$<br>(ii) $x(n) = e^{j\left(\left(\frac{\pi n}{2}\right)+\left(\frac{\pi}{8}\right)\right)}$ | 6 |
| 1.b | Let $x(n)$ be a signal with $x(n) = 0\ for\ n < -2\ and\ n > 4$. For the following signals, determine the values of "n" for which they are guaranteed to be zero.<br>(i) $x(n-3)$<br>(ii) $x(-n-2)$ | 4 |
| 1.c | Determine and Sketch the even and odd part of the following signal x(t) shown in figure.<br>  | 4 |
| 1d | For the continuous time signal $x(t)$ shown in figure,sketch<br>(i) $x(2-t)$<br>(ii) $x(2t+1)$<br>  | 6 |
| 2.a | Find the convolution between $x(n) = \alpha^n u(n)$ and $h(n) = \beta^n u(n)$, Where $\lvert\alpha\rvert < 1, \lvert\beta\rvert < 1\ and\ \alpha \neq \beta$ | 5 |

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| 2.b | Let $x(t) = u(t-3) - u(t-5)$ and $h(t) = e^{-3t}u(t)$<br>(i) Compute $y(t) = x(t) * h(t)$ Where the symbol "$*$" indicates the convolution between $x(t)$ and $h(t)$. Also sketch y(t) approximately.<br>(ii) Compute $g(t) = (d\,x(t)/dt) * h(t)$ and also sketch g(t) approximately. | 9 |
| 2.c | Check whether the following impulse responses are causal or not and also check whether they are stable or not.<br>(i) $h(n) = (0.2)^n u(n)$<br>(ii) $h(t) = e^{2t}u(-t-1)$<br>(iii) $h(n) = (-0.5)^n u(n) + (1.01)^n u(1-n)$ | 6 |
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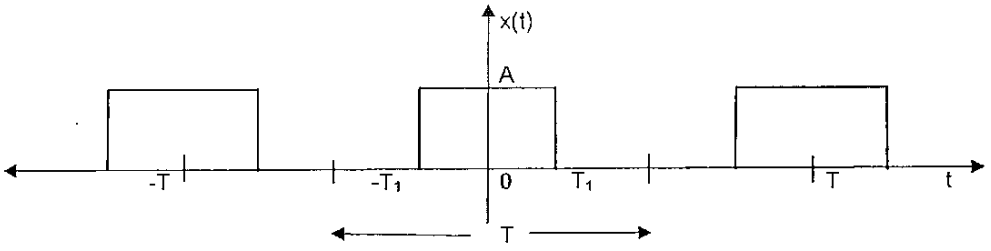
| 3.a | (i) Find the Fourier Series coefficients of the periodic signal x(t) with period "T". The signal x(t) is as shown below.<br>  <br><br>(ii) The signal $y(t)$ has Fourier Series coefficients "$b_k$" with Fundamental period 4.<br>$$b_k = \begin{cases} 0 & for\ k = 0 \\ (j)^k \dfrac{\sin\left(\frac{k\pi}{4}\right)}{k\pi} & for\ k \neq 0 \end{cases}$$<br>Using the results obtained in (i) and the Fourier Series Coefficients "$b_k$", find the signal $y(t)$ and also sketch it. | 12 |
| 3.b | State and prove Time shifting property for discrete time Fourier Series. | 4 |
| 3.c | Let x(n) be a real valued periodic signal with discrete time Fourier series coefficients $a_k$. Write the Fourier series coefficients of even part of x(n) and odd part of x(n). | 4 |
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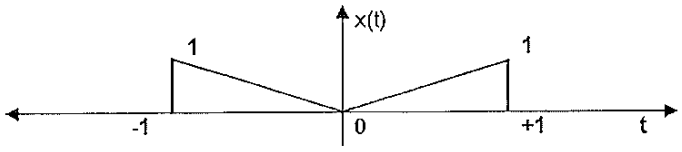
| 4.a | State and Prove<br>(i) Scaling property for continuous time Fourier Transform.<br>(ii) Parseval's relation for continuous time Fourier transform. | 10 |
| 4.b | Find the Fourier Transform of the signal x(t) shown in figure<br>  <br> | 6 |
| 4.c | Find the discrete time Fourier Transform of<br>$x(n) = (0.25)^n u(n-4)$. Also find the magnitude of the discrete time Fourier transform. | 4 |
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| 5.a | Find the Z-Transform of the following and sketch the region of convergence.<br>(i) $x(n) = \delta(n) + \delta(n-1) - \delta(n-2) - \delta(n-3)$<br>(ii) $x(n) = -3^n u(-n-1) + (0.2)^n u(n)$<br>(iii) $x(n) = 0.5^{\lvert n \rvert}$ | 8 |
| 5.b | Two sequences $x(n)$ and $h(n)$ are convolved in time domain. Show that the Z-Transform of $x(n) * h(n)$ is equivalent to $X(z)H(z)$ Where X(z) is the Z-Transform of x(n) and H(z) is the Z-Transform of h(n). The symbol " * " indicates convolution. | 4 |
| 5.c | The difference equation of an LTI system is given by $y(n) - 0.8y(n-1) = x(n)$ Given $x(n) = u(n)$ $and$ $y(-1) = 1$.<br>(i) Find the solution to the difference equation using Z-Transform.<br>(ii) In the obtained solution identify the forced response and natural response. | 8 |