

BITS, PILANI-DUBAI CAMPUS  
Knowledge Village, Dubai  
II YEAR, II SEMESTER, 2006-2007, COMPREHENSIVE EXAMINATION  
Course No.: EEE UC272 / INSTR UC272  
Course Name: CIRCUITS & SIGNALS  
Date: 31-05-2007 Duration: 3 hours Marks: 80 Weightage: 40%

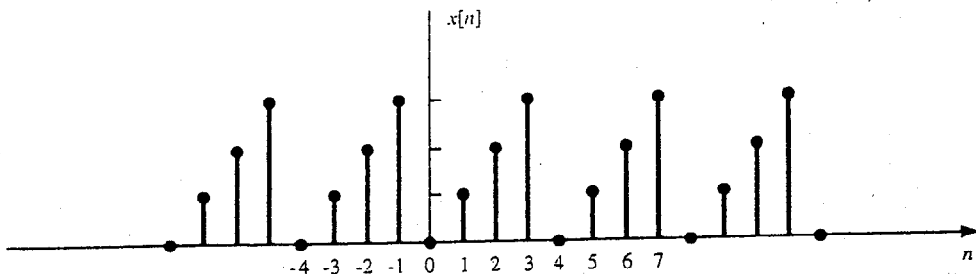
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**Note: Answer all questions. There are three parts, namely, Part A, Part B, and Part C that are to be answered on separate answer booklets.**

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**Part A (27 marks)**

1. The output  $y(t)$  of a continuous time LTI system is found to be  $2e^{-3t}u(t)$  when the input  $x(t)$  is  $u(t)$ . Find the impulse response  $h(t)$  of the system using Laplace transform. (7 marks)
2. Consider a continuous-time LTI system described by  $\frac{dy(t)}{dt} + 2y(t) = x(t)$ . If  $x(t) = e^{-t}u(t)$ , find output  $y(t)$  using Fourier Transform. (6 marks)
3. Using appropriate properties, obtain the Laplace transform of  $e^{-at} \cos(\omega_0 t)u(t)$ . (7 marks)
4. Determine the Fourier coefficients for the periodic sequence  $x[n]$  shown in figure. (7 marks)



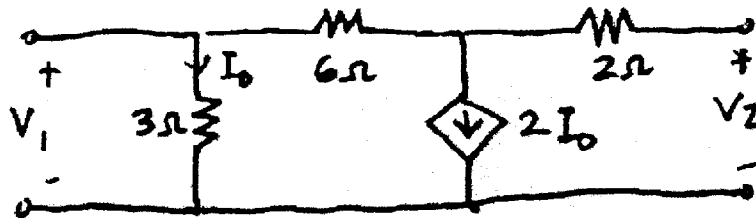
**Part B (26 marks)**

1. A second order system has poles at  $z = 0.7 \pm j0.8$ , no zeros, and a gain of one.
  - (a) Is the system stable? Explain.
  - (b) What is the transfer function of the system? (2+4 = 6 marks)

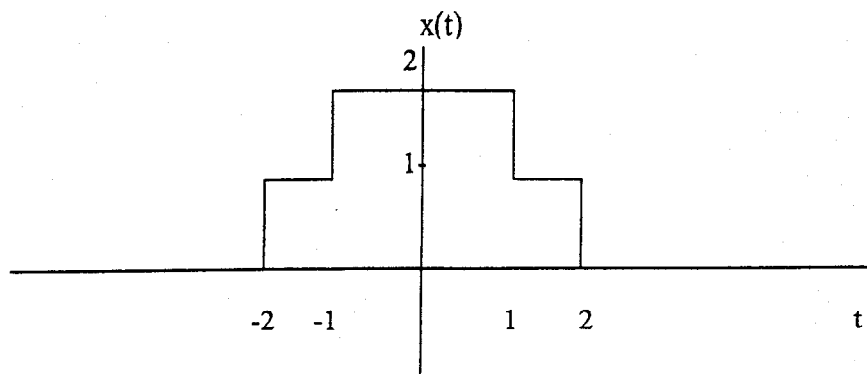
2. Find the z-transform of  $x[n] = (n-3)u[n]$ . (6 marks)
3. Distinguish between linear convolution and circular convolution for discrete-time sequences. (4 marks)
4. A piece of music is sampled at 44.1 kHz. A DFT window 23.22 msec long is used.
  - (a) How many time samples will be collected within the window?
  - (b) How many DFT samples do these samples produce?
  - (c) What is the resolution of the DFT? (1.5+1.5+3 = 6 marks)
5. By means of difference equations, explain the difference between IIR and FIR filters. (4 marks)

**Part C (27 marks)**

1. Find y-parameters of the following circuit (8 marks)



2. a) If  $x_1(t) = 5u(t-2)$  and  $x_2(t) = 5u(4-t)$ , then draw the waveform of  $x_3(t) = x_1(t) - x_2(t)$  (3 marks)
- b) Determine whether the signals are periodic or not. Justify.
  - i)  $\cos(t) + \sin(t\sqrt{2})$     ii)  $e^{-j2t}$  (4+4 = 8 marks)
3. Determine the Fourier transform of the signal shown in figure below in terms of the sinc function. (8 marks)



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**Test 2 (Open Book)**

**Course No.: EEE UC272 / INSTR UC 272**

**Course Name: Circuits & Signals**

**Date: 13/05/2007**

**Time: 50 minutes**

**Max. marks: 40**

**Weightage: 20 %**

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*Note:- Answer all questions.*

1. Find the poles and zeros and sketch the pole-zero plot for the transfer function  $H(z) = \frac{z^{-2}}{1 + 0.6z^{-1} + 0.05z^{-2}}$ . Is the system stable? Why or why not? (6 marks)
2. Find the transfer function  $H(z)$  and the difference equation for the filter with the impulse response  $h(n) = 2\delta(n) - 1.5\delta(n-1) + \delta(n-2) + 0.5\delta(n-3)$ . (6 marks)
3. Find the digital signal  $y[n]$  whose  $z$  transform is  $Y(z) = \frac{z}{z^2 - 0.75z - 0.25}$ . (8 marks)
4. The Laplace transform of a system is  $H(s) = \frac{s}{s^2 + 5s + 6}$ . If the input to the system is  $x(t) = e^{-t}u(t)$ , find the output  $y(t)$ . (8 marks)  
*y(t) = f(s)H(s)*
5. Consider the system  $y[n] = nx[n]$ . Test whether the system is linear or not. (4 marks)
6. Obtain the convolution of the functions  $e^{-3t}u(t)$  and  $2u(t)$  and sketch the result. (8 marks)

BITS, PILANI-DUBAI CAMPUS  
Knowledge Village, Dubai  
EEE / EIE II Year, II Semester, 2006-2007  
TEST-I (Closed Book)

Course No.: EEE UC272 / INSTR UC272 Course Title: Circuits & Signals

Date: 18 Mar 2007 Duration: 50 min Max. Marks: 40 Weightage: 20%

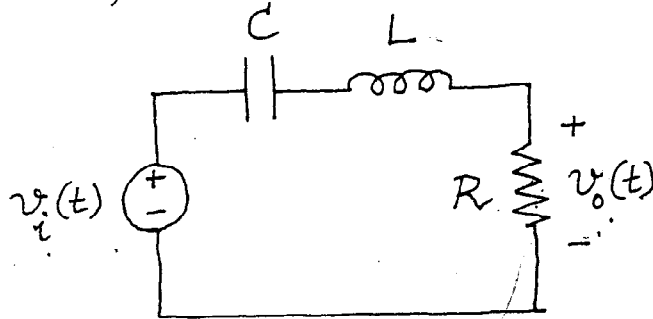
Note: Answer all questions

1. Realize the function

$$G(s) = \frac{V_o(s)}{V_i(s)} = \frac{4s}{s^2 + 4s + 20}$$

using the circuit shown below. Select  $R = 2\Omega$  and determine  $L$  and  $C$ .

(10 marks)



2. Obtain the complex exponential series representation for the signal  $x(t) = \cos 4t + \sin 6t$ . (6 marks)
3. Using appropriate properties, obtain the Fourier transform of the signal  $x(t) = \frac{\sin at}{\pi t}$ . (10 marks)
4. Find the inverse Fourier transform of  $4\delta(\omega - \omega_0)$ . (6 marks)
5. Sketch the functions: (a)  $f(t) = 5u(t) - 3u(t-1) - 2u(t-2)$ . (4 marks)
6. Evaluate the integral  $\int_1^2 (2t^2 + 5)\delta(t) dt$ . (4 marks)

NAME:-

ID:-

Version B

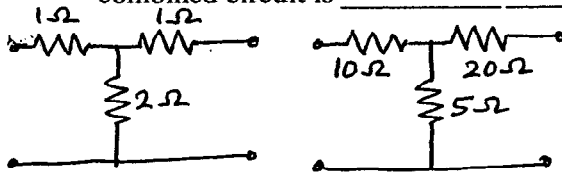
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EEE / EIE II Year, II Semester, 2006-2007  
QUIZ (Closed Book)

Course No.: EEE UC272 / INSTR UC272      Course Title: Circuits & Signals

Date: 27 Feb 2007    Duration: 30 min      Max. Marks: 20    Weightage: 10%

Note: Answer all questions. Show all steps.

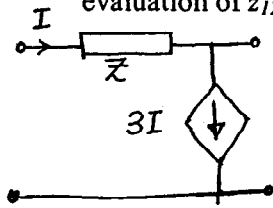
1. The two networks shown below are connected in series. Then  $z_{22}$  for the combined circuit is \_\_\_\_\_ (4 marks)



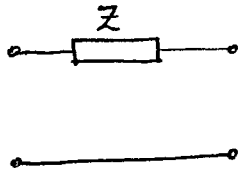
2. Define the two  $h$ -parameters:  $h_{12}$  and  $h_{21}$ . (2 marks)

3. The fundamental period of the signal  $x(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t\right)$  is \_\_\_\_\_ (4 marks)

4. The value of the current in the dependent current source below for the evaluation of  $z_{12}$  and  $z_{22}$  is \_\_\_\_\_ . (2 marks)



5. Find the transmission parameters for the single-element two-port network shown below. (4 marks)



6. Find  $y_{21}$  and  $y_{22}$  for the network shown below in terms of  $s$ . (4 marks)

