BITS PILANI DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
COMPREHENSIVE EXAMINATION 2010
CIRCUITS AND SIGNALS (EEE/ECE/INSTR C272)

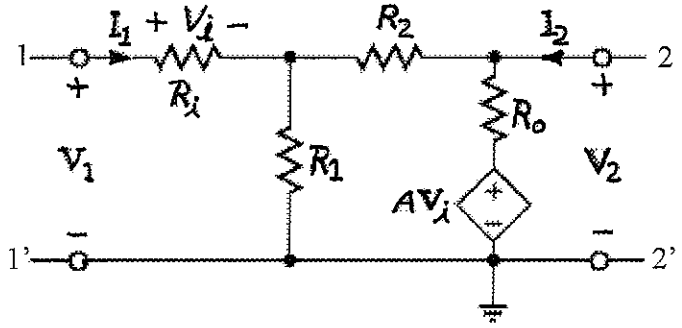
Date : 25-05-2010 **Time : 3 Hours**

Total marks : 120 (40%)

- *Write the answers for PART A, PART B and PART C questions in the prescribed answer books.*
- *Any missing data can be suitably assumed*

PART A

Q 1 Determine the Hybrid Parameters (h-parameters) for the following circuit. Assume the following values for $R_i = 1\ M\Omega$, $R_0 = 100\ \Omega$, $A = 1000$, $R_1 = 10\ K\Omega$ and $R_2 = 10\ K\Omega$ 15



Q 2A Is e^{-at} an energy or power signal, if 5

a) ***a*** is real
b) ***a*** is purely imaginary
c) What kind of a signal is it, if ***a*** is purely imaginary?

10

Q 2B Given the following equations where , the input and output are represented by f(t) and y(t) respectively. Determine in each case, whether the system is

I. Linear/Non-linear
II. Time- Invariant /Time-Varying
III. Causal/Non-causal
IV. Static/Dynamic

a) $y(t) = f(at) + f(t-2)$

b) $y(t) = \int_{-5}^{5} f(\tau)d\tau$

Justify your answer.

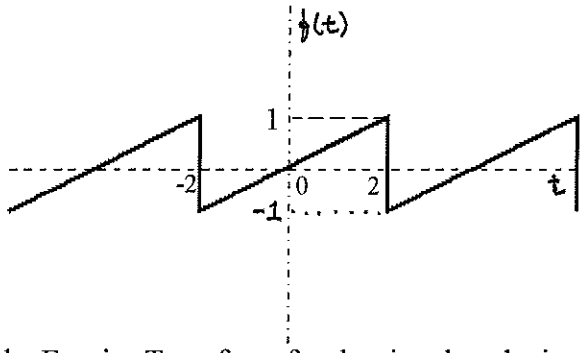
10

Q 3 For f(t) = sin(3t) u(t) and h(t) = e^{-t} u(t), find the convolved signal f*h.
Also, for f(t) = e^{-t} u(t) and h(t) = sin(3t) u(t), find the convolved signal f*h.

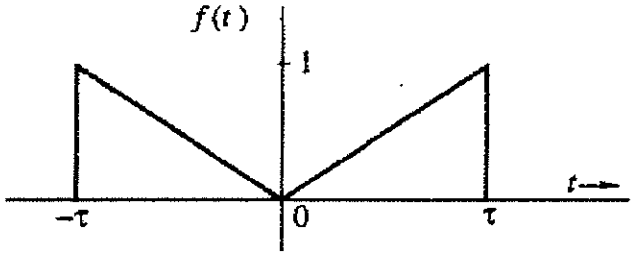
Note: $\int e^{ax}\sin(bx)dx = \dfrac{e^{ax}\left(a\sin(bx) - b\cos(bx)\right)}{\left(a^2+b^2\right)}$;

PART B

Q 1 Obtain the Complex Exponential Fourier series expansion and plot the line spectrum for the following signal *f(t)* 12



Q 2 Obtain the Fourier Transform for the signal as depicted in figure below 10



Q 3 18

For the system transfer function , $\boldsymbol{H(s)=\dfrac{s+5}{s^2+5s+6}}$, find

a) Impulse response of the system *h(t)*

b) Output of the system for the input $e^{-4t}u(t)$

PART C

Q 1 Consider an analog signal $x(t)=\left\{2\sin^2(200\pi t)(1+\cos(100\pi t))\right\}$ is ideally sampled at a rate of 1000 samples per second. Sketch the spectrum of the sampled signal. Suggest a method to recover the analog signal from its samples 8

Q 2A A given sequence $x_1(k)=\{1,-1,1,-1\}$ has its DFT $X_1(r)=\{0,0,4,0\}$. Using the DFT properties, obtain the DFT of the sequence $\{-1,1,-1,1\}$. State the property used. 6

Q 2B Consider a signal $x_1(k)$ having its DFT such that $X_1(r)=(0,-1+j,0,-1-j)$. If $x_2(k)=\{-1,-1,1,1\}$, obtain IDFT $\{X_1(r)X_2(r)\}$. 10

Q 3 Consider an LTI discrete time causal system described by the difference equation $y(k)=x(k)+\frac{5}{6}y(k-1)-\frac{1}{6}y(k-2)$, with *x(k)* as input and *y(k)* as the output. Find 16

a) System Transfer Function H(z) specifying the ROC.
b) Impulse Response *h(k)*
c) Also find the output *y(k)* if *x(k)=u(k)*

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CIRCUITS AND SIGNALS

DATE: 2-05-2010 TEST II (Open Book) MAX MARKS: 60(20%)

II Yr: II Sem . TIME: 50 MINS

Note : Answer **ALL** questions . Any missing data can be suitably assumed
Only Prescribed Text books and Handwritten Notes are admissible
Photo-copies of books or notes are not allowed for the Test .

1	**Consider the signal $M(\omega)$ defined as follows:** $$M(\omega)=\begin{cases}\frac{\omega}{10}+\left(1+\frac{\omega_c}{10}\right) & \text{for } -\omega_c-10\le\omega\le-\omega_c\\ -\frac{\omega}{10}+\left(1-\frac{\omega_c}{10}\right) & \text{for } -\omega_c\le\omega\le-\omega_c+10\\ \frac{\omega}{10}+\left(1-\frac{\omega_c}{10}\right) & \text{for } \omega_c-10\le\omega\le\omega_c\\ -\frac{\omega}{10}+\left(1+\frac{\omega_c}{10}\right) & \text{for } \omega_c\le\omega\le\omega_c+10\end{cases}$$ **1. Sketch $M(\omega)$** **2. Obtain the Inverse Fourier Transform *m(t)*.** **3. State (*not only list*) the Fourier Transform properties used.**	**(5)** **(10)** **(5)**
2	**Find the output y(t) for the system described by the following differential equation $\frac{d^2y}{dt^2}+y(t)=8x(t)$ with initial conditions $y(0^-)=0, \dot{y}(0^-)=2$ and input $x(t)=e^{-t}u(t)$ using Laplace Transform**	**(20)**
3	**Consider a signal $f(t)=2\sin(200\pi t)\,Cos(100\pi t)$ being sampled using the periodic impulse train with impulses spaced at an interval $T_s=$ 2 mSec. Sketch the spectrum of the sampled signal. If the sampled signal is passed through an ideal low-pass filter with a cut off frequency of 200 Hz , can the signal $f(t)$ be recovered ? Explain.**	**(5)**
4A	**If the $DFT(f(kT))=F(r\omega_0)=\{0,-1+j,2,-1-j\}$, by taking the Inverse DFT show that $f(kT)=\{0, -1, 1, 0\}$**	**(7)**
4B	**Consider two sampled sequences $f_1(kT)=\{0, 1, -2, 1\}$ and $f_2(kT)=\{1,-1, -1, 1\}$. Perform the 4 point Circular Convolution between $f_1(kT)$ & $f_2(kT)$ and show the result to be the sequence $\{2,-2,-2,2\}$**	**(8)**

ID No: _____

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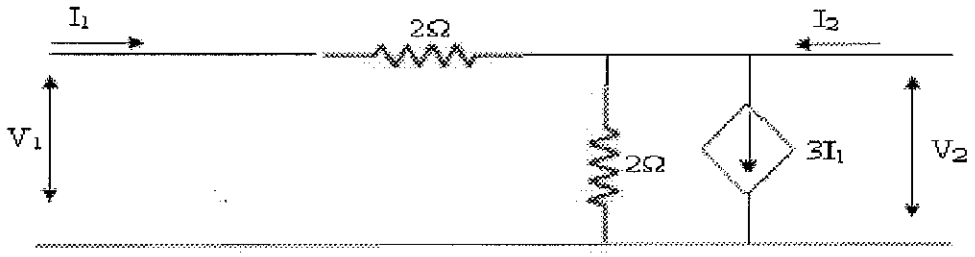
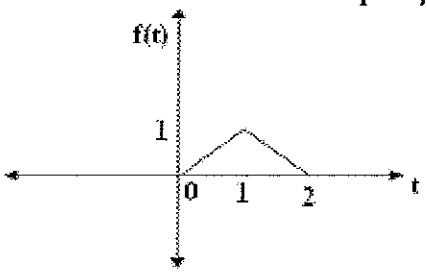
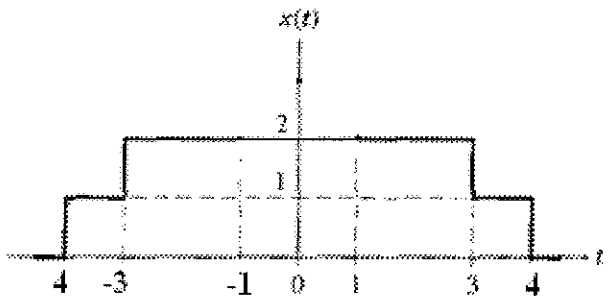
CIRCUITS AND SIGNALS

DATE: 21-03-2010 TEST I MAX MARKS: 75 (25%)

TIME: 50 MINS

*Note : Answer **ALL** questions . Any missing data can be suitably assumed*

1	**Obtain the z parameters and draw the z parameter equivalent circuit for the following two port network.** 	15
2A	**Let** $x(t) = \begin{cases} 5\cos 5\pi t & -1 \le t \le 1 \\ 0 & otherwise \end{cases}$ **calculate the energy associated with** $x(t)$.	6
2B	**Sketch the Even and Odd part,of the following signal .** 	6
2C	**Simplify the following expression** $\left(\frac{\cos t}{t^2+2}\right)\delta(t)$	3
3A	**Express the following signal in terms of weighted shifted unit step functions** 	8

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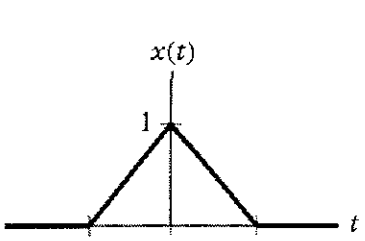
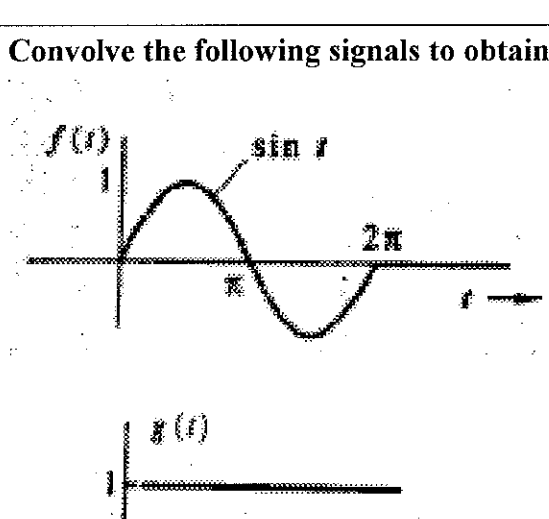
3B	**A triangular pulse x(t) is shown below. Sketch the modified signal x(3t+2).** 	7
4	**A system , specified by its input x(t) and output y(t) is such that** $y(t) = \cos(x(t))$ **. Determine whether the system is** **a) Linear and b) time invariant**	15
5	**Convolve the following signals to obtain the output** $y(t) = f(t) * g(t)$ 	15

SET A

BITS, PILANI-DUBAI
Dubai International Academic City, Dubai

BE (Hons.) EEE / ECE / EIE II Year, II Semester, 2009-2010
Quiz II (Closed Book)
Course No.: **EEE C272 / INSTR C 272** Course Title: **Circuits and Signals**
Date: Apr 13 , 2010 Time: 20 min Max. Marks: 24 Weightage: 8%

Name :	**Student Id :**	**Section :**

Note: Answer all questions. Appropriate assumptions may be made wherever necessary

1. Consider the periodic wave $f(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t - 60^\circ\right)$. Determine the fundamental period of $f(t)$ in seconds and the angular frequency ω_0 in rad/sec (5 Marks)

Answer =

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2. The Complex exponential Fourier series coefficients for certain function $f(t)$ are $F_1 = \left(5\sqrt{2}\right)\angle 45^\circ$ and $F_{-1} = \left(5\sqrt{2}\right)\angle -45^\circ$ with other Fourier Coefficients being zero. Obtain the synthesized function (5 Marks)

Hint : $f(t) = \sum_{n=-\infty}^{\infty} F_n e^{jn\omega_0 t}$ where F_n is the Fourier Coefficient expressed in polar form

3. Find the Complex Exponential Fourier series for the periodic square wave with the fundamental period T = 2 seconds and defined by $x(t)=\begin{cases}-1 & \text{for } -1 \le t \le 0 \\ 1 & \text{for } 0 \le t \le 1\end{cases}$ .Sketch the Line spectra (8 Marks)

Answer =

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4. Let **f(t)** be a unit gate function and **$F_1(\omega)$** its transform .Let **$F_2(\omega)$** be the transform of **f(t/3).** If the first zero crossing from origin of $F_1(\omega)$ is 2π (for $\omega \ge 0$), what is the corresponding zero crossing of $F_2(\omega)$? State the property associated. (6 marks)

BITS, PILANI-DUBAI **SET B**

Dubai International Academic City, Dubai

BE (Hons.) EEE / ECE / EIE II Year, II Semester, 2009-2010

Quiz II (Closed Book)

Course No.: **EEE C272 / INSTR C 272** Course Title: **Circuits and Signals**

Date: Apr 13 , 2010 Time: 20 min Max. Marks: 24 Weightage: 8%

Name :	Student Id :	Section :

Note: Answer all questions. Appropriate assumptions may be made wherever necessary

1. Consider the periodic wave $f(t) = \cos\left(\frac{2\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t - 60^\circ\right)$. Determine the fundamental period of $f(t)$ in seconds and the angular frequency ω_0 in rad/sec (5 Marks)

Answer =

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2. The Complex exponential Fourier series coefficients for certain function $f(t)$ are $F_1 = \left(5\sqrt{2}\right)\angle 60^\circ$ and $F_{-1} = \left(5\sqrt{2}\right)\angle -60^\circ$ with other Fourier Coefficients being zero. Obtain the synthesized function $f(t)$ (5 Marks)

Hint : $f(t) = \sum_{n=-\infty}^{\infty} F_n e^{jn\omega_0 t}$, where F_n is the Fourier Coefficient expressed in polar form

3. Find the Complex Exponential Fourier series for the periodic square wave with the fundamental period T = 4 seconds and defined by $x(t) = \begin{cases} -1 & \text{for } -2 \le t \le 0 \\ 1 & \text{for } 0 \le t \le 2 \end{cases}$ .Sketch the Line spectra (8 Marks)

Answer =

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4. Let **f(t)** be a unit gate function and **$F_1(\omega)$** its transform .Let **$F_2(\omega)$** be the transform of **f(t/5).** If the first zero crossing from origin of $F_1(\omega)$ is 2π rad/sec , (for $\omega \ge 0$), what is the corresponding zero crossing of $F_2(\omega)$? State the property associated. (6marks)

BITS, PILANI-DUBAI
Dubai International Academic City, Dubai

BE (Hons.) EEE / ECE / EIE II Year, II Semester, 2009-2010
Quiz I (Closed Book)
Course No.: **EEE C272 / INSTR C 272** Course Title: **Circuits and Signals**
Date: Mar 2 , 2010 Time: 20 min Max. Marks: 24 Weightage: 8%

Note: Answer all questions. Appropriate assumptions may be made wherever necessary

1. Consider the two port network as shown in fig P1 . Obtain its Y parameters (6 Marks)

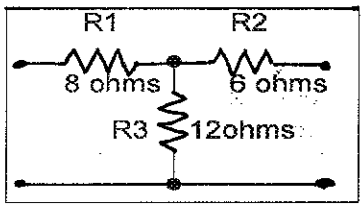


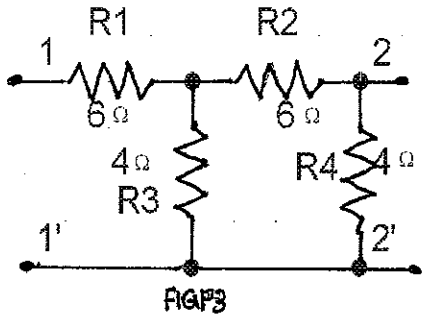
Fig. P1

Answer =

2. A ' T ' network is specified by its Z parameters in terms of $[z]=\begin{bmatrix}12 & 8\\ 8 & 14\end{bmatrix}$. Draw the ' T ' network.If the port 1 is excited by a 10 V dc source , Calculate the current carried by an 18 ohm resistive load connected across the port 2. (6 Marks)

Answer =

3. Determine the transmission parameters of the two port network shown in Fig P3 (6 Marks)



FIGP3

Answer =

4. Consider the signal $x(t)$ as shown in Fig P4. If this signal undergoes a modification as $x\left(\frac{t}{3}-2\right)$, sketch the modified signal and calculate the energy of the modified signal (6 Marks)

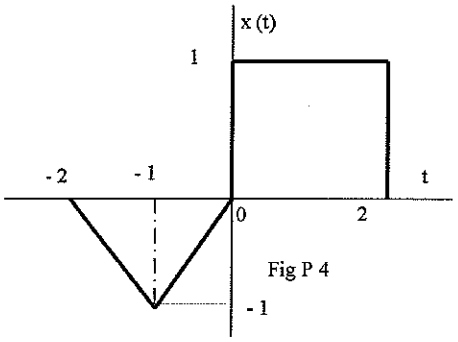


Fig P 4

Answer =