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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent Institution of MAHE, Manipal)

IV SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: SIGNALS AND SYSTEMS [ELE 2201]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 19 April 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Transform Table may be supplied.

1A. If discrete time signal $h[n]=\begin{cases}\frac{n}{2}; & -4\le n\le 4\\ 0; & otherwise\end{cases}$, sketch and label the following signals

(i) $y[n]=h[n+2]+h[-1-n];$ (ii) $y[n]=2h[n]\times h[2n];$ ***(03)***

1B. Determine whether the following signals are energy signals or power signals, also find the energy and power of signals.

(i) $x(t)=e^{-at}u(t);$ where $a>0$ (ii) $x[n]=2e^{j3n};$ ***(03)***

1C. Find the response $y(t)=x(t)*h(t)$ where $x(t)=\begin{cases}1; & 0\le t\le 2\\ 0; & otherwise\end{cases}$ and $h(t)=x\left(\frac{1}{2}t\right)$ ***(04)***

2A. Following are the impulse response of LTI systems. Check whether each system is memoryless, causal and/or stable (i) $h[n]=\left(\frac{4}{5}\right)^n u[n+4]$ and (*ii*) $h(t)=e^{-3t+1}u(t-2)$ ***(02)***

2B. Compute $y[n]=x[n]*h[n];$ where $x[n]=\left(\frac{1}{2}\right)^n u[n-4]$ and $h[n]=\left(4^n\right)u[2-n]$ ***(04)***

2C. Obtain the complete response of an LTI system described by the difference equation:

$y[n]-\frac{7}{6}y[n-1]+\frac{1}{3}y[n-2]=x[n].$ Given: $x[n]=\left(\frac{1}{2}\right)^n u[n]$; $y[-1]=2$, $y[-2]=-1.$ Use time-domain method. ***(04)***

3A Determine the time domain signal corresponding to the DTFT representation.

Given: $\left|X\left(e^{j\Omega}\right)\right|=\begin{cases}1; & \frac{\pi}{3}\le\Omega\le\frac{2\pi}{3}\\ 0; & otherwise\end{cases}$ and $\angle\left\{X\left(e^{j\Omega}\right)\right\}=-3\Omega$ ***(04)***

3B. Find the Exponential Fourier series coefficient of a periodic continuous time signal $x(t)$ shown in Fig. Q. 3B. Also plot the magnitude spectrum. ***(04)***

3C. For continuous-time signal $x(t)$ shown in Fig.Q.3C, evaluate the following without computing $X(j\omega)$.

(i) $\int_{-\infty}^{\infty} X(j\omega)e^{j\omega}d\omega$ (ii) $\int_{-\infty}^{\infty} |X(j\omega)|^2 d\omega$ ***(02)***

4A. Use the properties of Fourier transform to find the time-domain signal $x(t)$ for the signal $X(j\omega) = j\frac{d}{d\omega}4\left[\cos(3\omega)\frac{\sin(\omega)}{\omega}\right]$ ***(04)***

4B. For the system shown in Fig.Q4B find the Fourier transform of $g(t)$ .Given: $x(t) = \frac{\sin 3\pi t}{\pi t}$ and $p(t) = \cos \pi t$ ***(03)***

4C. A discrete time periodic signal $x[n]$ is real valued and has a fundamental period $N_0 = 5$

The nonzero Fourier series coefficients for $x[n]$ are;

$$X(0) = 2;\ \ X(2) = X(-2)^* = e^{j\frac{\pi}{4}};\ \ X4 = X(-4)^* = 2e^{j\frac{\pi}{3}};$$

Hence find discrete time signal $x[n]$. ***(03)***

5A. Given that $x[n] = \left(\frac{1}{3}\right)^n u[n] \leftrightarrow X\left(e^{j\Omega}\right)$ Without evaluating $X\left(e^{j\Omega}\right)$, find $y[n]$ if

$$y\left(e^{j\Omega}\right) = \frac{d}{d\Omega}\left\{e^{-j\Omega}\left[X\left(e^{j\left(\Omega+\frac{\pi}{3}\right)}\right) - X\left(e^{j\left(\Omega-\frac{\pi}{3}\right)}\right)\right]\right\}$$ ***(04)***

5B. Find the inverse z-transform of

$$X[z] = \frac{z}{\left(z-\frac{1}{2}\right)(z-2)^2} \quad |z| > 2$$ ***(03)***

5C. Use properties to find the Z-transform of signal $x[n] = n\left(\frac{1}{3}\right)^{n-1} u[n-2]$ ***(03)***

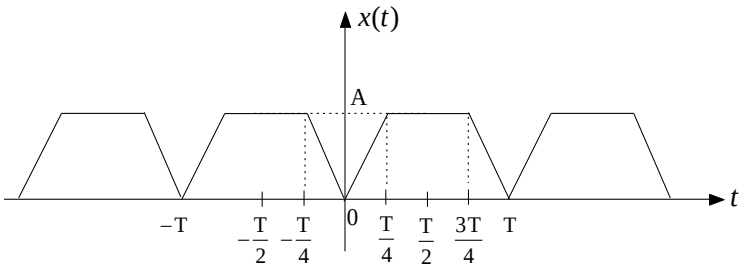

Fig.Q3B

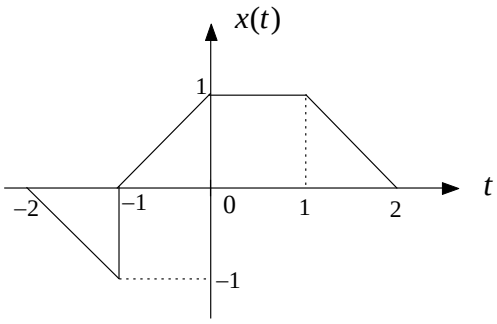

Fig.Q3C

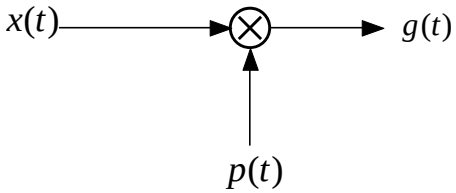

Fig.Q4B