Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 42442

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Third Semester

Electronics and Communication Engineering

EC2204 – SIGNALS AND SYSTEMS

(Common to Biomedical Engineering)

(Regulations 2008)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Determine the fundamental period of a signal $x[n] = 1 + e^{i4\pi n/7} - e^{i2\pi n/5}$.

2. Find whether the given system y(t) = x(sin(t)) is casual or not.

3. Determine the Fourier series representation of the signal $x(t) = 5\cos\left(\frac{\pi}{2}t + \frac{\pi}{6}\right)$.

4. Find the initial value theorem for $x(t) = 5\ e^{-4t}$ using Laplace transform.

5. Convert the following differential equation into integral form and obtain the block diagram representations.
   $\frac{dy(t)}{dt} + 5\ y(t) = x(t)$

6. List out the advantages of state space representation of a system.

7. Find the DTFT of the signal x[n] = {2, 1, 4, 1, 2}.

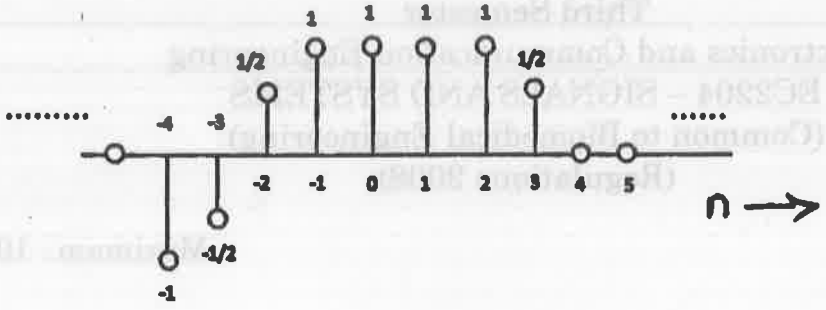
8. Determine the ROC and Z-transform of a given signal $x[n] = \left(\frac{1}{2}\right)^n u[n] + \left(\frac{1}{3}\right)^n u[n]$.

9. State the relationship between the DTFT and Z-transform.

10. List out the properties of convolution sum.

PART – B (5×16=80 Marks)

11. a) A discrete time signal is given below.



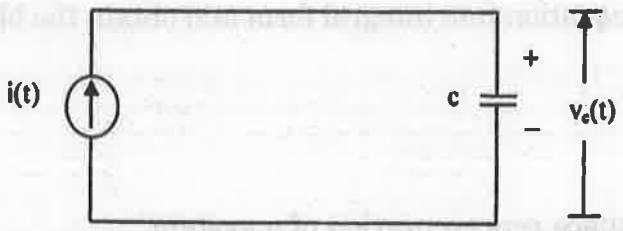
Sketch and label carefully each of the following signals :

1) x[3 – n] 2) x[3n + 1]

3) x[n – 2] δ[n – 2] 4) x[(n – 1)^2] **(16)**

(OR)

b) Consider the capacitor shown in the given figure. Let input x(t) = i(t) and output y(t) = v_c(t).



i) Find the input-output relationship.

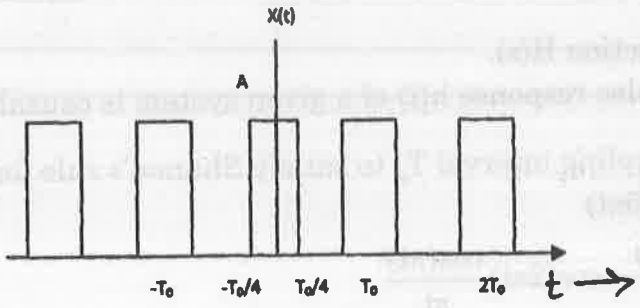
ii) Determine whether the system is

1) Memoryless 2) Causal

3) Linear 4) Time invariant

5) Stable. **(16)**

12. a) i) Consider the periodic square wave x(t) shown in given figure.
   1) Determine the complex exponential Fourier series of x(t).
   2) Determine the trigonometric fourier series of x(t).



(10)

ii) Find the Fourier series co-efficient for the given signal

$$x(t) = 1 + \sin \omega_0 t + 2\cos \omega_0 t + \cos\left(2\omega_0 t + \frac{\pi}{4}\right)$$

and also plot the magnitude and phase spectrum. (6)

(OR)

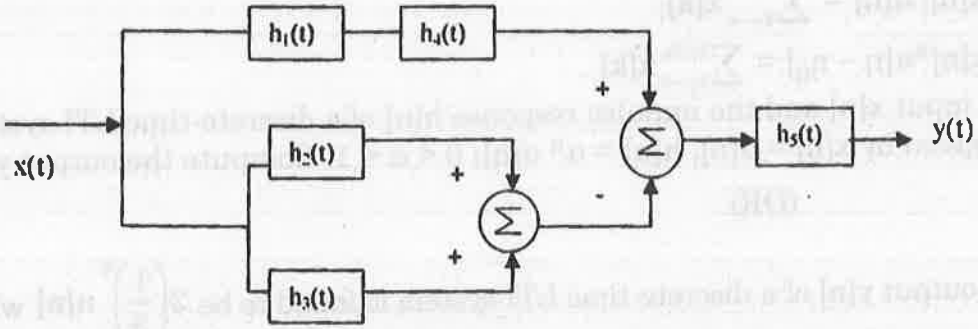
b) i) Find the FT of the signum function, sgn(t) defined as

$$\text{sgn}(t) = \begin{cases} +1, & t > 0 \\ 0, & t = 0 \\ -1, & t < 0 \end{cases}$$

and plot the spectrum. (8)

ii) Find the Laplace transform of the given signal $x(t) = (e^{-3t}\, u(t))^* (t.\, u(t))$. (8)

13. a) i) Obtain the expression for the impulse response of the interconnection systems shown in the given figure. (8)



ii) Perform the convolution of two signals, $x_1(t) = e^{-\alpha t}\, u(t)$ and $x_2(t) = e^{-\beta t}\, u(t)$. (8)

(OR)

b) i) Find the natural response of an LTI system described by the differential equation. (8)

$$4\frac{dy(t)}{dt} + 8\, y(t) = x(t);\ y(0) = 2$$

ii) Consider a continuous-time LTI system for which the input x(t) and output y(t) are related by

$$\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}-2\,y(t)=x(t)$$

1) Find the system function H(s).
2) Determine the impulse response h(t) of a given system is causal. (8)

14. a) i) Find the minimum sampling interval T_s to satisfy Shanon's rule for
1) $x(t)=\cos(2\pi t)+\cos(5\pi t)$
2) $x(t)=\cos(2\pi t)\frac{\sin(\pi t)}{\pi t}+\cos(2\pi t)\frac{\cos(\pi t)}{\pi t}$. (8)

ii) State and prove the Time shifting property and Parseval relationship property of DTFT. (8)

(OR)

b) i) Find X(z) for the given x[n], using linearity and multiplication by an exponential properties.
$x[n]=a^n\cos(\Omega n)\,u[n]$. (8)

ii) Determine x[n] if

$$x[z]=\frac{1-z^{-1}+z^{-2}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-2z^{-1}\right)\left(1-z^{-1}\right)}$$ (8)

15. a) i) Show that
1) $x[n]*\delta[n]=x[n]$
2) $x[n]*\delta[n-n_0]=x[n-n_0]$
3) $x[n]*u[n]=\sum_{k=-\infty}^{n}x[k]$
4) $x[n]*u[n-n_0]=\sum_{k=-\infty}^{n-n_0}x[k]$. (8)

ii) The input x[n] and the impulse response h[n] of a discrete-time LTI system are given by $x[n]=u[n]$, $h[n]=\alpha^n u[n]$; $0<\alpha<1$. Compute the output y[n]. (8)

(OR)

b) i) The output y[n] of a discrete-time LTI system is found to be $2\left(\frac{1}{3}\right)^n u[n]$ when the input x[n] is u[n]. Find the impulse response h[n] of the system. (8)

ii) Find the state equation of a discrete-time system described by

$$y[n]-\frac{3}{4}y[n-1]+\frac{1}{8}y[n-2]=x[n]$$ (8)