

# CBCGS SCHEME

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18EC45

## Fourth Semester B.E. Degree Examination, July/August 2022 Signals and Systems

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. Differentiate between Energy and Power signals. Identify whether  $u(t)$  is energy or power signals. Compute its energy / power. (08 Marks)
- b. Given the signals  $x(t)$  &  $y(t)$  in the Fig. Q1(b), sketch
  - i)  $x(t - 2) + y(1 - t)$
  - ii)  $x(t) - y(t + 2)$ . (08 Marks)

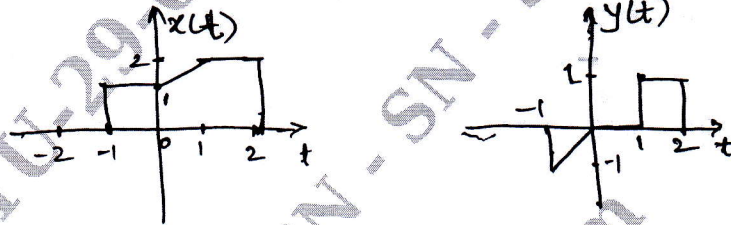


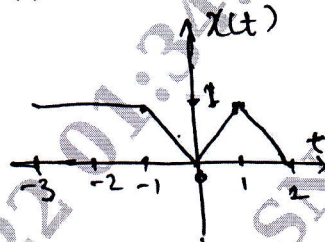
Fig. Q1(b)

- c. Sketch the signal  $Z(t) = r(t + 2) - r(t + 1) - 2u(t) + u(t - 1)$ . (04 Marks)

OR

- 2 a. For the signal shown in Fig. Q2(a), sketch its Even and Odd components. (06 Marks)

Fig. Q2(a)



- b. Identify whether the following signals are periodic or not? If Periodic what is the period of it?
  - i)  $x(t) = \cos \sqrt{2} t + \sin 2 \pi t$
  - ii)  $x(t) = \cos 8 \pi t$
  - iii)  $x(n) = \sin \frac{\pi}{6} n + \sin \frac{\pi}{3} n$ . (08 Marks)
- c. Sketch the signals : i)  $u(t - 2) - 2u(t) + u(t + 2)$     ii)  $e^{-2t} \{u(t) - u(t - 2)\}$ . (06 Marks)

### Module-2

- 3 a. Check whether the following system is linear, time variant, causal, static and stable.  
 $Y[n] = 2x[1 - n] + 2$ . (08 Marks)
- b. Compute the following convolutions :
  - i)  $y(t) = x(t) * h(t)$ , where  $x(t) = u(t + 2)$  and  $h(t) = e^{-2t} u(t)$ .
  - ii)  $y(t) = x(t) * h(t)$ , where  $x(t) = e^{-1+1}$  and  $h(t) = u(t)$ . (12 Marks)

OR

- 4 a. The system is described by the differential equation
 
$$\frac{dy(t)}{dt} = 2x(t) + \frac{d}{dt} x(t).$$
 State whether this system is linear, time variant, causal and static. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. i) Evaluate  $y(n) = x(n) * h(n)$ , if  $x(n) = \alpha^n u(n)$   $\alpha < 1$  &  $h(n) = u(n)$ .  
 ii) Evaluate  $y(t) = x(t) * h(t)$ , if  $x(t)$  &  $h(t)$  are as shown in Fig. Q4(b(ii)). (12 Marks)

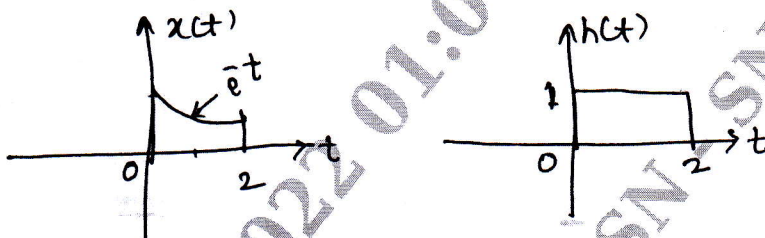


Fig. Q4(b(ii))

**Module-3**

- 5 a. Impulse responses of the various systems are described below. Identify whether these systems are memoryless, causal and stable.  
 i)  $h(n) = 2\delta(n)$     ii)  $h(t) = e^{-2t} u(t+2)$     iii)  $h(t) = 2 \{u(t) - u(t-2)\}$ . (10 Marks)  
 b. Obtain the Fourier representations of the signals :  
 i)  $x(n) = \cos 2\pi n + \sin 4\pi n$  with  $\Omega_0 = 2\pi$     ii)  $x(t)$  shown in Fig. Q5(b(ii)). (10 Marks)

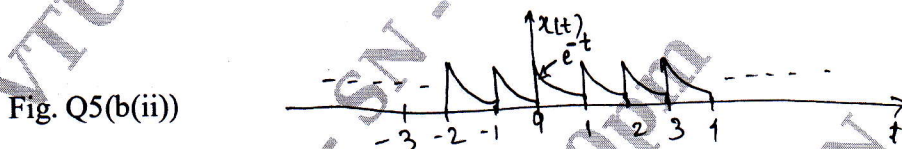


Fig. Q5(b(ii))

OR

- 6 a. Find the overall impulse response of the system shown in Fig. Q6(a). (08 Marks)

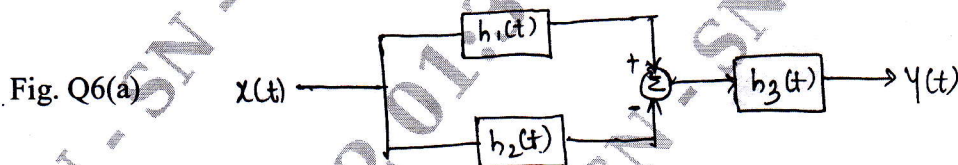


Fig. Q6(a)

where  $h_1(t) = u(t+1)$ ,  $h_2(t) = u(t-2)$ ,  $h_3(t) = e^{-3t} u(t)$ .

- b. State and prove time shift property of Fourier Series. (06 Marks)  
 c. Obtain DTFS coefficients of  $x(n)$  if  $\Omega_0 = 3\pi$ . (06 Marks)  
 i)  $x(n) = \sin 6\pi n$     ii)  $x(n) = \cos 3\pi n + \sin 9\pi n$ .

**Module-4**

- 7 a. State and prove Convolution property of DTFT. (06 Marks)  
 b. Find F.T. of the signal shown in Fig. Q7(b). (06 Marks)

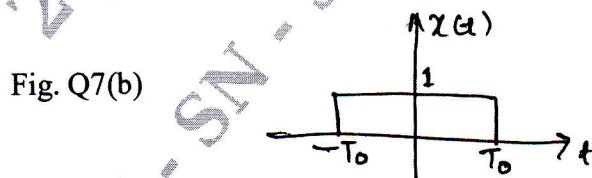


Fig. Q7(b)

- c. Find the time domain signal  $x(t)$  if its F.T.  $X(j\omega)$  given below : (08 Marks)  
 i)  $X(j\omega) = \frac{j\omega}{(j\omega)^2 + 5j\omega + 6j\omega}$     ii)  $X(j\omega) = \frac{1-j\omega}{1+\omega^2}$

OR



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- 8 a. State and prove Parseval's theorem for Fourier transform. (06 Marks)  
 b. Using properties, find the DTFT of the signals. (06 Marks)  
 i)  $x(n) = (\frac{1}{2})^n u(n+2)$  ii)  $x(n) = n \cdot a^n u(n)$ .  
 c. Obtain the signal  $x(t)$ , if its Fourier transform is (08 Marks)  
 i)  $X(j\omega) = \frac{1}{2 + j(\omega - 3)}$  ii)  $X(j\omega) = e^{-j3\omega} \frac{1}{j\omega + 2}$

**Module-5**

- 9 a. Find the Z - transform of the signals. (07 Marks)  
 i)  $x(n) = (\frac{1}{2})^n u(n) - (\frac{3}{2})^n u(-n-1)$  ii)  $x(n) = (-\frac{1}{3})^n u(n)$ .  
 b. State and prove differentiation in the Z - domain property of Z - transform. (06 Marks)  
 c. Use Partial fraction expansion to find the inverse Z - transform of (07 Marks)  

$$X(z) = \frac{z^2 - 3z}{z^2 - \frac{3}{2}z - 1} \quad \frac{1}{2} < |z| < 2$$

OR

- 10 a. Use properties to find Z - transform of the following signals : (08 Marks)  
 i)  $x(n) = 3^n u(n-2)$  ii)  $x(n) = n \sin\left(\frac{\pi}{2}n\right) u(n)$ .  
 b. Find the Inverse Z - transform. (12 Marks)  
 i)  $X(z) = \frac{1}{1 - \frac{1}{2}z^{-1}} + \frac{2}{1 - 2z^{-1}} \quad |z| > 2$   
 ii)  $X(z) = \frac{2+z^{-1}}{1 - \frac{1}{2}z^{-1}} \quad |z| < \frac{1}{2}$ , Use Power Series Expansion method.

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