CBCS SCHEME

USN

18EC45

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Missing data to be assumed.***

Module-1

1 a. Distinguish between: i) Periodic and Non periodic signals ii) Event and ODD signals with one example for each. **(06 Marks)**

b. Check whether the given signals are energy or power signals by inspection. Also find appropriate finite energy or power : i) $x(n) = (-0.5)^n u(n)$ ii) $x(t) = A \cos(\omega_0 t + \theta)$ **(08 Marks)**

c. Given x(t) as shown in Fig Q1(c). Sketch i) $y_1(t) = x(-2t-1)$ ii) $y_2(t) = x(-2t+3)$.

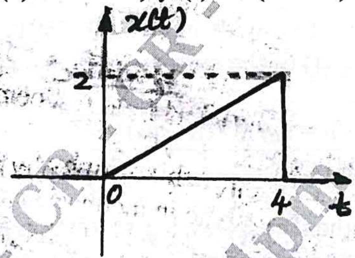

Fig Q1(c) **(06 Marks)**

OR

2 a. Determine and sketch the EVEN and ODD parts of the signal shown in Fig Q2(a).

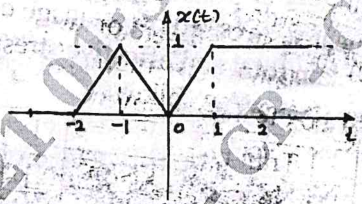

Fig Q2(a) **(06 Marks)**

b. Given the signals x(t) and g(t) as shown in Fig Q2(b)-(i), (ii). Express x(t) in terms of g(t).

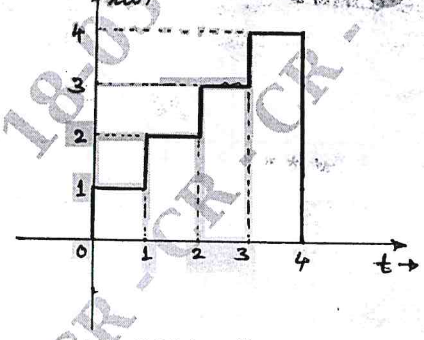

Fig Q2(a) – (i)

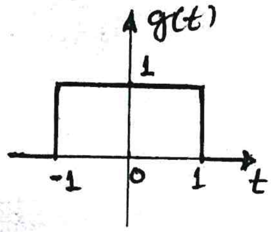

Fig Q2(a) – (ii) **(06 Marks)**

c. Find whether the following signals are periodic or not. If periodic, find the fundamental period.

i) $x(n) = \cos\frac{\pi}{2}n \cdot \sin\frac{\pi}{4}n$

ii) $x(n) = \cos 2\pi t + \sin 4\pi t$. **(08 Marks)**

Module-2

3 a. Determine whether the following system represented by input – output relationship is i) Linear ii) Memoryless iii) Causal iv) Time invariant v) Stable

$y(t) = \sin 6t\, x(t)$ **(08 Marks)**

b. Convolve :

i) $x_1(n) = \alpha^n u(n)$ and $x_2(n) = \beta^n u(n)$

ii) $x(t) = e^{-at} u(t)$ and $h(t) = u(t)$ **(07 Marks)**

c. State and Prove Associate property of convolution sum. **(05 Marks)**

OR

4 a. Given an LTI system with input $x(t) = e^{-t}u(t)$ and impulse response $h(t) = u(t) - u(t-2)$. Find the output y(t) of the system. Also sketch y(t). **(10 Marks)**

b. Show that :

i) $x(n) * \delta(n - n_0) = x(n - n_0)$

ii) $x(t) * u(t) = \int_{-\infty}^{t} x(\tau)\,d\tau$ **(04 Marks)**

c. Determine whether the following systems represented by input-output relationship are stable and causal i) $y(n) = x(n)\,u(n+1)$ ii) $y(t) = t\,x(t)$. **(06 Marks)**

Module-3

5 a. For each of the impulse response given below, Determine whether the corresponding system is memoryless, causal and stable.

i) $h(t) = e^{-2|t|}$ ii) $h(n) = 2^n u(n-1)$. **(08 Marks)**

b. Determine the step response of the system whose impulse response is given by $h(t) = t^2\,u(t)$. **(04 Marks)**

c. State and prove the following properties of continuous time Fourier series

i) Time shift ii) Time Differentiation. **(08 Marks)**

OR

6 a. Find the complex Fourier coefficient for the periodic signal x(t) shown in Fig Q6(a). Also draw the Amplitude and phase spectra.

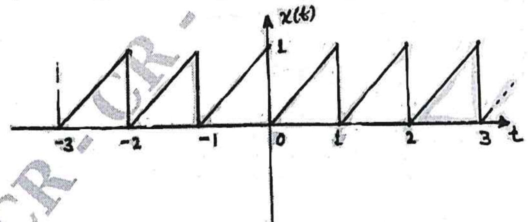

Fig Q6(a) **(10 Marks)**

b. Find the step response of an LTI system whose impulse response is given by $h(n) = \delta(n) + \delta(n-1)$ **(04 Marks)**

c. Investigate causality and stability of the following systems given by their impulse responses i) $h(n) = (0.5)^{|n|}$ ii) $h(t) = e^{2t}\,u(t-1)$. **(06 Marks)**

c. Find whether the following signals are periodic or not. If periodic, find the fundamental period.

i) $x(n) = \cos \frac{\pi}{2} n \cdot \sin \frac{\pi}{4} n$

ii) $x(n) = \cos 2\pi t + \sin 4\pi t$. **(08 Marks)**

Module-2

3 a. Determine whether the following system represented by input – output relationship is i) Linear ii) Memoryless iii) Causal iv) Time invariant v) Stable
$y(t) = \sin 6t\, x(t)$ **(08 Marks)**

b. Convolve :

i) $x_1(n) = \alpha^n u(n)$ and $x_2(n) = \beta^n u(n)$

ii) $x(t) = e^{-at} u(t)$ and $h(t) = u(t)$ **(07 Marks)**

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i) $h(t) = e^{-2|t|}$ ii) $h(n) = 2^n u(n-1)$. **(08 Marks)**

b. Determine the step response of the system whose impulse response is given by $h(t) = t^2 u(t)$. **(04 Marks)**

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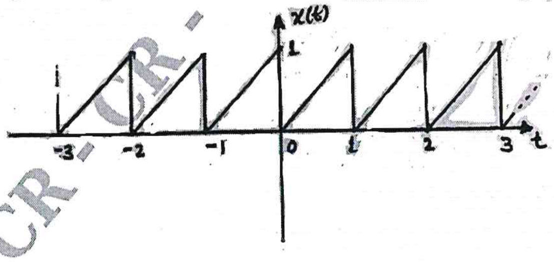

Fig Q6(a) **(10 Marks)**

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$h(n) = \delta(n) + \delta(n-1)$ **(04 Marks)**

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i) $h(n) = (0.5)^{|n|}$ ii) $h(t) = e^{2t} u(t-1)$. **(06 Marks)**