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G 1621

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Reg. No.....

Name.....

**B.TECH. DEGREE EXAMINATION, MAY 2016**

**Fourth Semester**

Branch : Electronics and Communication / Applied Electronics and Instrumentation /  
Electronics and Instrumentation / Information Technology

**SIGNALS AND SYSTEMS (L A S T)**

(Old Scheme—Prior to 2010 Admissions)

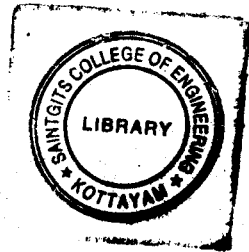
[Supplementary/Mercy Chance]

Time : Three Hours

Maximum : 100 Marks

**Part A**

*Answer all questions.  
Each question carries 4 marks.*



1. What is BIBO stability ? Prove the condition on  $h(t)$  for a system to be stable ?
2. Find the convolution sum of the following sequences :

$$x_1(n) = \{1, 2, 3\}, x_2(n) = \{3, 1, 4\}$$

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3. Find the Fourier Transform of the rect function which is unity over the interval  $-0.5$  to  $+0.5$ , and zero elsewhere.
4. Find the Fourier Transform of the signal  $x(t) = te^{-kt} u(t)$ . What is the restriction on  $K$  for the Fourier Transform to exist ?
5. Find the Discrete Fourier Series representation of a periodic sequence  $x(n) = \{1, 1, 0, 0\}$  with period  $N = 4$ .
6. Find the DTFT  $x(\Omega)$  of the signal  $x(n) = \{1, 2, 3, 2, 1\}$  and evaluate  $x(\Omega)$  at  $\Omega = 0$ .
7. Explain the properties of ROC of z-transform.
8. Determine the Laplace Transform of a unit ramp signal.
9. State the important properties of cross-correlation function  $R_{xy}(\tau)$ .
10. Give an auto correlation function  $R_{xx}(\tau)$ , can you determine a unique  $x(t)$  ? Why ?

(10 × 4 = 40 marks)

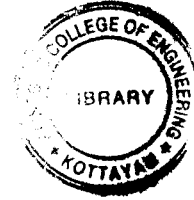
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## Part B

Answer all questions.  
Each full question carries 12 marks.

11. Check whether the following systems are :

- (a) Linear / non-linear.
- (b) Causal or non-causal.
- (c) Time variant / time invariant.
- (d) Stable / unstable ?



(i)  $y(t) = x(t^4)$ .      (ii)  $y(n) = x(n) + nx(n-1)$ .

(6 + 6 = 12 marks)

Or

12. (a) Convolve the sequences  $\alpha^n u[n]$  and  $\beta^n u[n]$ .

(4 marks)

(b) Find the output response of the system described by the differential equation

$$\frac{d^2 y}{dt^2} + 5 \frac{dy}{dt} + 6y = 5e^{-t}$$

(8 marks)

13. Determine the complex exponential Fourier series expansion of the periodic signal

$$x(\theta) = \begin{cases} A \cos \theta & , \quad 0 \leq \theta \leq \pi \\ 0 & , \quad \pi \leq \theta \leq 2\pi \end{cases}$$

Or

14. (a) Calculate the energy contained in the signal  $x(t) = 5e^{-3t} u(t)$  using time domain equation and then using Parseval's theorem.

(8 marks)

(b) Use duality principle to find the Fourier Transform of  $x(t) = 10 \text{Sinc } 20t$ .

(4 marks)

15. (a) Find the DTFS coefficients of the sequence  $x(n) = \cos\left(\frac{6\pi n}{13} + \frac{\pi}{6}\right)$ .

(6 marks)

(b) The signal  $x(n) = \{1, 0.5\}$  is applied to a system with frequency response  $H(\Omega)$  and the resulting output is  $y[n] = \delta[n] - 2\delta[n-1] - \delta[n-2]$ . Find  $H(\Omega)$ .

(6 marks)

Or

16. (a) Explain convolution and modulation properties of DTFT.

(6 marks)

(b) Determine the response of the system if  $x(n) = \cos\left(\frac{\pi n}{2}\right)$ . The difference equation of the system is  $y(n) = \frac{1}{2}y(n-1) + x(n) + \frac{1}{2}x(n-1)$ .

(6 marks)

17. (a) Find z-transform of  $x(n) = \left(\frac{1}{5}\right)^n u(n) + \left(\frac{1}{8}\right)^n u(n)$ .

(6 marks)

(b) Determine the poles and zeros for the differential equation  $y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n) - x(n-1)$  and also find out ROC.

(6 marks)

Or

18. (a) Using Laplace Transform, solve the differential equation  $\frac{d^2y(t)}{dt^2} + y(t) = x(t)$ , if  $\frac{dy(0^-)}{dt} = 2, y(0^-) = 1$  for input  $x(t) = \cos 2t$ .

(6 marks)

(b) The system function of a causal LTI system is  $H(s) = \frac{s+1}{s^2+2s+2}$ . Determine the response  $y(t)$  when the input  $x(t) = e^{-t}$ .

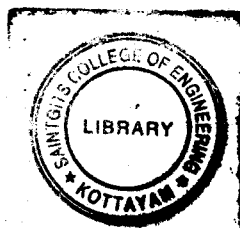
(6 marks)

19. (a) Determine the autocorrelation function and energy spectral density of  $x(t) = e^{-at} u(t)$ .

(6 marks)

(b) A random variable X has the uniform distribution given by  $f_x(x) = \begin{cases} \frac{1}{2\pi} & , 0 \leq x \leq 2\pi \\ 0 & , \text{otherwise} \end{cases}$

Determine  $m_x, \bar{X}^2$  and  $\sigma_x$ .



Or

(6 marks)

Turn over

20. A stationary Random process  $X(t)$  has the following autocorrelation function  $R_X(\tau) = \sigma^2 e^{-\alpha|\tau|}$  where  $m$  and  $\sigma^2$  are the constants. It is passed through a filter whose impulse response is  $h(\tau) = \alpha e^{-\alpha\tau} u(\tau)$ , where  $\alpha$  is a constant and  $u(t)$  is a step function.

- (i) Find the Power Spectral Density of random signal  $X(t)$ .
- (ii) Find the Power spectral Density of the output random signal  $Y(t)$ .

(6 + 6 = 12 marks)

[5 × 12 = 60 marks]

