D 51029 (Pages : 3)

Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, NOVEMBER 2013

EC 09 304/PT 09 303—SIGNALS AND SYSTEMS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

Each question carries 2 *marks.*

I. (a) What are the conditions for a system to be stable ?

(b) Give an example each for an even signal and odd signal.

(c) State the necessary and sufficient conditions for the existance of the Fourier series representation of a signal.

(d) How stability of a LTI system can be checked by Laplace transform ?

(e) How is z-transform obtained from Laplace transform ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

Each question carries 5 *marks.*

II. (a) Check whether the following signal is periodic or not. If it is periodic, determine its fundamental period $x(t) = e^{j(\pi t - 1)}$.

(b) Determine whether the following system is linear or not $5\frac{dy(t)}{dt} + y(t) = 5x(t)$.

(c) Using the convolution property of Fourier transform, find the output response of the LTI system with

$h(n) = e^{-at}\, u(t)$ for $a > 0$.

$x(n) = e^{-bt}\, u(t)$ for $b > 0$.

(d) Evaluate the discrete time Fourier transform of $x(n) = a^{|n|}$; $|a| < 1$.

(e) Find the Laplace transform and the region of convergence of $x(t) = -e^{-at}\, u(-t)$.

(f) Evaluate the z-transform of $x(n) = -a^n\, u(-n-1)$. Also find the ROC.

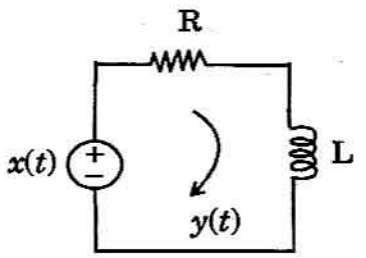
(4 × 5 = 20 marks)

Turn over

Part C

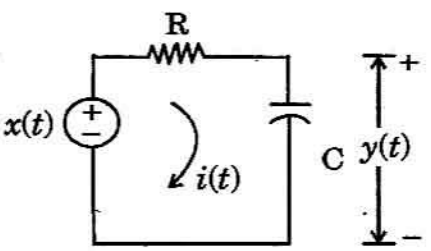
Answer **all** *questions.*
Each question carries 10 *marks.*

III. (a) Find the current is the RL circuit given below for an applied voltage $x(t)$ = cost volts assuming normalised values R = 1Ω, L = 1H and the initial condition $y(0)$ 2A.

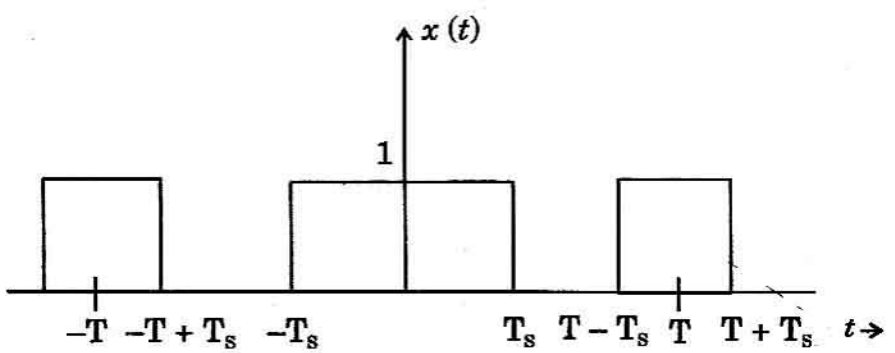


Or

(b) The impulse response of the system relating the input voltage to the voltage across the capacitor in the given figure is given by $h(t) = \frac{1}{RC} e^{-t/RC} u(t)$. Find an expression for the frequency response and plot the magnitude and phase response.

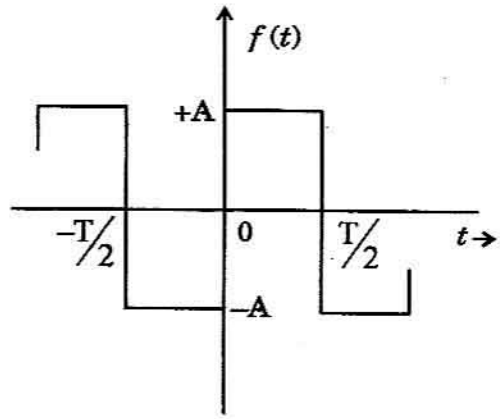


IV. (a) Determine the Fourier transform representation of a square wave shown in the figure.



Or

(b) Determine the exponential Fourier series and hence find a_n and b_n of the trigonometric Fourier series of the given waveform. Compare the results.



V. (a) Find the inverse Laplace transform of

$$X(s) = \frac{-5s-7}{(s+1)(s-1)(s+2)}$$

(i) ROC $-1 < \mathrm{Re}(s) < 1$.

(ii) ROC $-2 < \mathrm{Re}(s) < -1$.

Or

(b) Use the Laplace transform to determine the output of a system represented by the differential equation $\frac{d^2 y(t)}{dt} + 5\frac{d}{dt} y(t) + 6y(t) = 2\frac{d}{dt} x(t) + x(t)$ in response to the input $x(t) = u(t)$. Assume that initial conditions are $y(0^+) = 1$ and $\left.\frac{dy(t)}{dt}\right|_{t=0^+} = 2$.

VI. (a) Determine the casual signal $x(z)$ having the z-transform $X(Z) = \frac{1}{\left(1+Z^{-1}\right)\left(1-Z^{-1}\right)^2}$.

Or

(b) Find the z-transform and ROC of the signal $x(n) = \left[n\left(\frac{-1}{2}\right)^n u(n)\right] * \left(\frac{1}{4}\right)^{-n} u(-n)$.

(4 × 10 = 40 marks)