R18 Regulation *Subject code:* 2P6BD

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech VI Semester Regular/Supplementary Examinations, June 2022

SIGNALS AND SYSTEMS

(Electrical and Electronics Engineering)

Maximum Marks: 70 Date:21.06.2022 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 Relate the impulse signal, step signal, ramp signal.

2 Calculate the Power and RMS value of the signal $x[n] = 5\sin\left(\frac{5n\pi}{7}\right) + 6\cos\left(\frac{3n\pi}{2}\right)$

3 What is the necessary and sufficient condition on the impulse response for stability?

4 Determine the response of the system with impulse response h(t)=u(t) for the input $x(t) = e^{-2t}u(t)$

5 When a periodic signal is said to have half wave symmetry?

6 Compute the inverse Fourier transform of the signal $\delta(\Omega)$.

7 Find the step response of a system whose impulse response is given as $e^{-2t}u(t)$

8 Sketch the poles and zeros for the following difference equation $x[n] = (-1)^n u[n] - 4(-1)^{n-2} u[n-2]$ in the z plane.

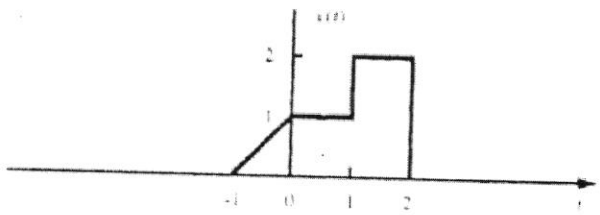
9 Determine the Nyquist rate and Nyquist sampling interval for the signal $\sin(200\pi t) + \sin(300\pi t)$

10 What is an anti aliasing filter.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 A continuous time signal x(t) is given below



(i)Examine the Energy of the signal x(t) (4)

(ii)Plot the signals $x(t+3)$, $x\left(\frac{t}{2}-1\right)$, $x(2t+1)$ and categorize their respective energies (6)

OR

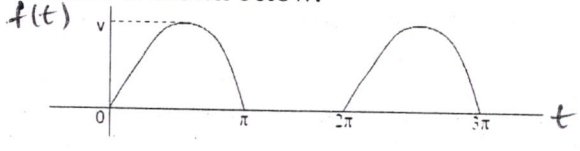
12 (i)Examine whether the following system are time invariant or not (5)
a)$y(t) = e^{x(t)}$ b) $y[n] = x[n] + nx[n]$
(ii)Examine whether the following system are Linear or Non linear (5)
a) y(t)=x(-t) b)y[n]=log x[n]

13 (i) Find the convolution between the following signals $x_1(t) = e^{-at}u(t)$ and $x_2(t) = e^{-bt}u(t)$
(ii) Analyze the stability for the following system with the impulse response
a) $t\,e^{-t}u(t)$ b) $e^{-2|t|}$ (5+5)

OR

14 Find the state space representation of the following system whose Differential equation representation is
$\frac{d^3y(t)}{dt^3} + 3\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6\,y(t) = \frac{d^2x(t)}{dt^2} + 6\frac{dx(t)}{dt} + 5x(t);$ (10)

15 The output of a half wave rectifier is shown below. (10)

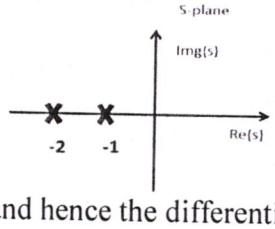


Develop the exponential Fourier Series and hence estimate the DC component of the rectified wave.

OR

16 (i) Apply fourier transform on the signal $x(t) = e^{-at}u(t),\ a > 0$. Also sketch the magnitude spectrum and phase spectrum. (5)
(ii)State Parseval's theorem. Apply the theorem to estimate Energy contained in the signal $x(t) = e^{-at}u(t),\ a > 0$ (5)

17 The pole Zero plot of a causal stable LTI system is given below. (10)



(i) Determine the Transfer function and hence the differential equation that describes the system.
(ii) Assuming Zero initial conditions, determine the Impulse response of the system.
(iii) Determine the output response of the system to the input$x(t) = e^{-3t}u(t)$

OR

18 Derive the any five properties of Z Transform. (10)

19 State and prove sampling theorem for band limited signals. The signal $x(t) = 10\cos(10\pi t)$ is sampled at a rate of 8 samples per second. Plot the amplitude spectrum for $|w| \le 30\pi$. Can the original signal be recovered from its samples? Explain. (10)

OR

20 (i) Consider the analog signal $x(t) = 5\sin 4500\pi t + 12\cos 2000\pi t$. Determine the rate at which the signal has to be sampled to avoid aliasing. ? If the analog signal is sampled at f_s=5000Hz, formulate the discrete time signal obtained by sampling. (6)
(ii)Formulate the transfer function of Zero order hold system. (4)