INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
(Dundigal-500043, Hyderabad)

B.Tech III SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022
Regulation:UG-20
SIGNALS AND SYSTEMS

Time: 3 Hours   (ECE)   Max Marks: 70

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Write about elementary signals. Derive condition for orthogonality of two signals. **[7M]**

   (b) Determine whether the following signal is periodic signal or aperiodic signal. In the case of periodic signal, determine the fundamental period.

   $x(t) = 5\cos 4\pi t + 3\sin 8\pi t$ **[7M]**

MODULE – II

2. (a) Obtain time shifting, time reversal and time scaling properties of Fourier series. **[7M]**

   (b) Find the Fourier transform of the signal $x(t) = x_1(t) * x_2(t)$,where $x_1(t) = e^{-2t}u(t)$ and $x_2(t) = u(t)$ **[7M]**

MODULE – III

3. (a) State and derive the relationship between bandwidth and rise time. **[7M]**

   (b) Find the impulse response and step response of continuous time LTI system is described by the equation $\dfrac{\mathrm{d}y(t)}{\mathrm{d}t} + 5y(t) = x(t)$ **[7M]**

4. (a) Explain the concept of convolution in time domain and frequency domain. **[7M]**

   (b) The output y(t) of a continuous-time LTI system is found to be $2e^{-3t}u(t)$ when the input x(t) is u(t). Find the impulse response h(t) of the system. **[7M]**

MODULE – IV

5. (a) Find the Laplace transform and ROC of the signal $x(t) = e^{-3t}u(t) + e^{-2t}u(t)$ **[7M]**

   (b) Determine the inverse Z transform of the sequence $X[Z] = \dfrac{1 + 2z^{-1}}{1 - 2Z^{-1} + Z^{-2}}$ **[7M]**.

6. (a) State and prove linearity, time shifting and time convolution properties of Z – transform. **[7M]**

   (b) Find the inverse Laplace transform of $X(s) = \dfrac{1}{(s + 4)(s - 2)}$, ROC $-4 < Re(s) < 2$. **[7M]**

MODULE – V

7. (a) Explain the effect of under sampling. Derive the expression for transfer function of flat top sampled signal. **[7M]**

(b) A signal $e^{-3t}u(t)$ is passed through an ideal LPF with cut-off frequency of 1 rad/s.
   i) Test whether the input is an energy signal
   ii) Find the input and output energy **[7M]**

8. (a) Apply the sampling theorem to find the Nyquist rate and sampling interval corresponding to each of the following analog signals: **[7M]**

   i) $x(t) = 1 + \cos 2000\pi t + \sin 4000\pi t$

   ii) $x(t) = [\dfrac{(\sin 4000\pi t}{\pi t}]^2$

(b) Explain relation between convolution and correlation. Prove that for a signal, auto correlation and PSD form a Fourier transform pair. **[7M]**

$$- \circ\, \circ\, \bigcirc\, \circ\, \circ\, -$$