Con. 6618–11.

MP–3895

(3 Hours)

[Total Marks : 100]

N.B. : (1) Question No. **1** is **compulsory**.

(2) Attempt any **four** from remaining **six** questions.

(3) Assume any **suitable** data if **necessary** and Make it **clearly**.

1. (a) Determine whether following signals are energy signals or power   4
signals ? Calculate their energy or power.

(i) $x(t) = A \cos(2\pi f_0 t + \theta)$

(ii) $x[n] = \left[\dfrac{1}{4}\right]^n u[n]$

(b) Determine whether following signals are periodic or non periodic ? If periodic,   4
find fundamental period.

(i) $x(t) = 5 \cos(4\pi t) + 3 \sin(8\pi t)$

(ii) $x[n] = \sin\left[\dfrac{6\pi}{7} n + 1\right]$

(c) Check whether following systems are linear or nonlinear, Time-Invariant or   4
Time variant, causal or non causal.

(i) $y(t) = x(t) \cdot \cos 100\pi t$

(ii) $y(n) = x(n) + n \cdot x[n+1]$

(d) Find the initial value $X(0)$ and final value $X(\infty)$ of following :   4

$$x(z) = \dfrac{1}{1 + 2z^{-1} - 3z^{-2}}$$

(e) Find the fourier Transform of double sided exponential signal.   4

2. (a) Determine the exponential form of fourier series representation of signal shown   10
in fig 2·1 Hence determine the trignometric form of fourier series.
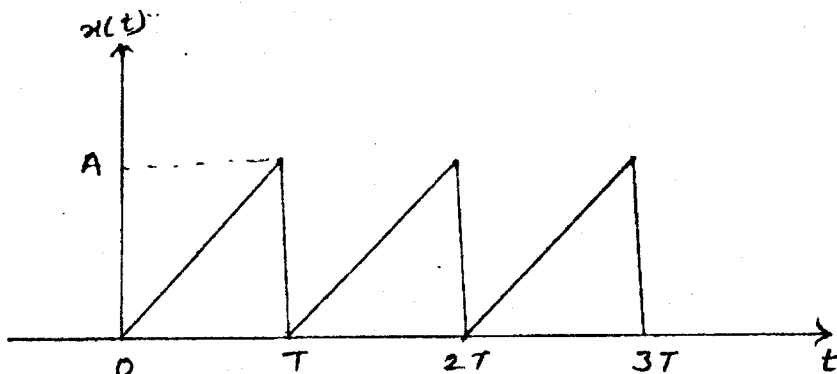

Fig 2.1

[TURN OVER

Con. 6618–MP–3895–11.   **2**

(b) (i) Plot the signal with respect to time.   **10**

$$x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3) + u(t-4) - 2u(t-5)$$

  (ii) Find the even and odd parts of this signal.

3. (a) Obtain the fourier Transform of periodic gate function of amplitude A, period **10**
   To and width τ as shown in fig 3·1. Plot the magnitude spectrum.
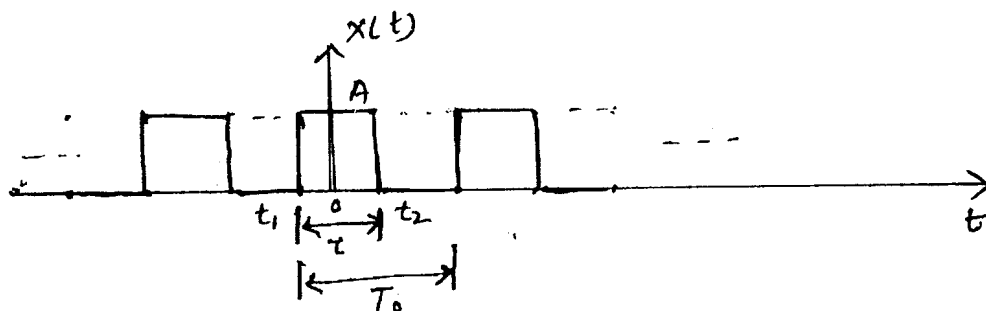

Fig 3·1

(b) State and prove following properties of Fourier Transform.   **6**
   (i) Convolution in Time domain
   (ii) Differentiation in Time domain.

(c) Explain Gibb's phenomenon.   **4**

4. (a) An analog signal.   **10**

$$x_a(t) = \sin[480\pi t] + 3\sin(720\pi t) \quad \text{is sampled 600 times per second.}$$

   (i) Determine the Nyquist sampling rate for $x_a(t)$.
   (ii) Determine the folding frequency.
   (iii) What are the frequencies, in radians, in resulting discrete time signal $x(n)$.
   (iv) If $x(n)$ is passed through an ideal D/A converter, what is the reconstructed signal $Y_a(t)$. ?

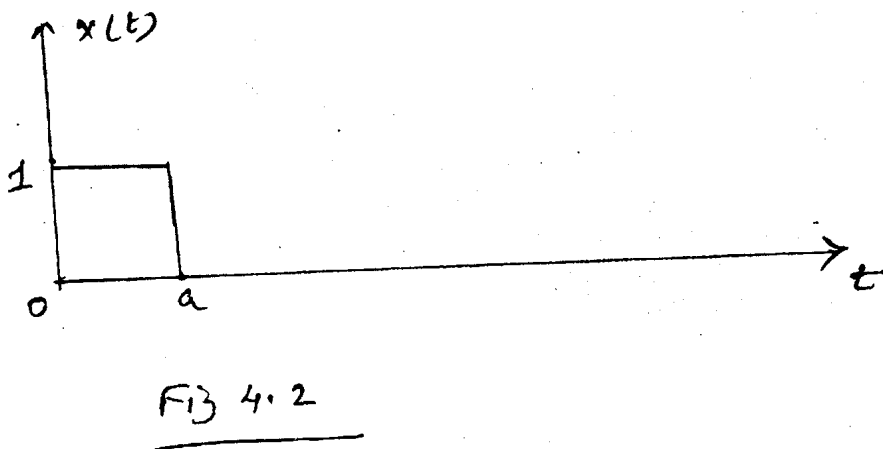(b) Determine the laplace transform of the signals shown in Fig. 4·1 and Fig. 4·2.   **6**

(i)

$x(t)$

Fig 4·1

(ii)

$x(t)$

Fig 4·2
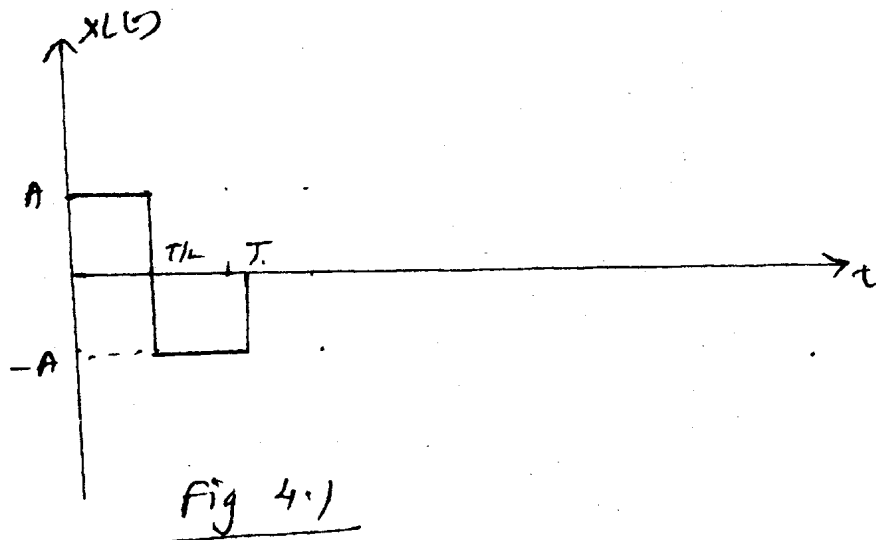
(c) Determine the laplace transform of following using properties of laplace   **4**
transform.

$$x(t) = (t^2 - 2t)\ u\ (t - 1).$$

5. (a) Determine the z – transform and sketch R.O.C.   **8**

(i) $x_1[n] = \left[\dfrac{1}{3}\right]^n\ ; n \geq 0$

(ii) $x_2[n] = x_1[n + 4]$

[TURN OVER

Con. 6618–MP–3895–11.   4

(b) Determine the convolution of following pairs of signals by means of   **8**
z – transform.

$$x_1[n] = \left[\frac{1}{4}\right]^n u[n-1]$$

$$x_2[n] = \left[1 + \left(\frac{1}{2}\right)^n\right] u(n)$$

(c) Explain properties of region of convergence [R.O.C.] of z – transform.   **4**

6. (a) The difference equation of system is given by—   **10**
       $y(n) = 3y[n-2] + 4y[n-1] + x[n]$
       If $x[n] = [0.5]^n u[n]$ and
       $y[-1] = 1, y[-2] = 0$
    Find (i) Zero Input Response
       (ii) Zero state Response
       (iii) Total Response.

(b) A system is described by following difference equation.   **10**

$$y[n] = \frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) + x(n) + x(n-1)$$

Obtain
       (i) Direct form I Realization
       (ii) Direct form II Realization
       (iii) Cascade Realization.

7. (a) LTI system is characterized by system function —   **8**

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$

Specify R.O.C of H(z) and determine h(n) for
       (i) System is stable
       (ii) System is causal.

(b) Using a suitable method obtain the state transition matrix e^{At} for the following   **8**
system.

$$A = \begin{bmatrix} -12 & \dfrac{2}{3} \\ -36 & -1 \end{bmatrix}$$

(c) Find relationship between Discrete Time fourier Transform and z - Transform.   **4**

Con. 6366-11.

(3 Hours)

[Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.

(2) Attempt any **four** of remaining **six** questions.

(3) Assume any **suitable** data wherever required but justify the **same**.

(4) **Figures** to the **right** indicate the **full** marks.

1. (a) Write short notes on followings; (20)

Chip components

Microstrip lines and strip lines

Large signal FET model

ABCD Parameters

2. (a) Explain what is Skin depth? Calculate the skin depth for copper and aluminum at 0.86

and 1.2 GHz? Also find the resistance of an 8 cm wire with diameter of 1.5 mm?

$\sigma_{cu} = 64.516 \times 10^6$ (s/m), $\sigma_{Al} = 40 \times 10^6$ (s/m) (10)

(b) Explain with the equivalent circuits the Radio frequency behavior of Resistor,

Inductor and Capacitor? (10)

3. (a) Explain the following terms related to the filter Design?

Insertion Loss, Ripple Factor, Bandwidth (06)

(b) Explain why the ideal filter response cannot be realized? (04)

(c) Design the Butterworth High pass filter having cutoff frequency of 250 MHz and -15

dB response at 200 MHz? (10)

4. (a) Plot the following Impedance points on the smith chart? $Z_0 = 50\Omega$.

$23 + j\,42\Omega$, $12 - j\,109\Omega$, $72 + j\,42.5\Omega$ and $115 - j\,22\Omega$.

Calculate their equivalent admittance using smith chart? (08)

(b) Calculate the input impedance of the Transmission line using equations and the smith

Chart, for $Z_0 = 50\Omega$, $Z_l = 110 + j\,22\Omega$, $\varepsilon_r = 1.0$, length of the line = 20 cm and

operating frequency equal to 1.8 GHz? (12)

[TURN OVER

5. (a) Explain the equivalent circuit of the transmission line?   (05)

(b) Derive the input impedance equation of Transmission line of length 'l'?   (05)

(c) Using the input impedance equation of Transmission line, derive the input impedance

equation for shorted and open circuit transmission line and draw their voltage, current

and impedance waveforms?   (10)

6. (a) Define and derive AC parameters for BJT and FETs?   (10)

(b) Write short notes on,

High Electron Mobility Transistors, Small signal BJT model?   (10)

7. (a) How the capacitors and inductors are realized using the sections of transmission line?

Explain the same using the smith charts?   (06)

(b) What are Kuroda Identities? How they are used in realization of RF filters?   (10)

(c) Explain what are Schottky Contacts?   (04)

29|11|11 TE (EXTC) Sem - V
Random Signal Analysis

Con. 5977-11.

MP-3892

(3 Hours)

[Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
  (2) Out of remaining questions, attempt any **four** questions.
  (3) Assume **suitable** additional data if **required**.
  (4) **Figures** in brackets on the **right** hand side indicate **full** marks.

1. (A) Discuss the properties of cross correlation function. (05)
   (B) If A and B are two independent events then prove that $P(A \cap \overline{B}) = P(A).P(\overline{B})$. (05)
   (C) State and explain Bayes Theorem. (05)
   (D) Suppose five cards to be drawn at random from a standard deck of cards. If all the drawn cards are red, what is the probability that all of them are hearts? (05)

2. (A) A random variable has the following exponential probability density function: $f(x) = Ke^{-|x|}$. Determine the value of K and the corresponding distribution function. (10)
   (B) Define discrete and continuous random variables by giving examples. Discuss the properties of distribution function. (10)

3. The joint probability density function of two random variables is given by (20)
   $$f_{x,y}(x, y) = 15e^{-3x-3y} : x \geq 0, y \geq 0$$

   i) Find the probability that x < 2 and y > 0.2.
   ii) Find the marginal densities of x and y.
   iii) Are x and y independent.
   iv) Find $E(x/y)$ and $E(y/x)$.

4. (A) State and prove the Chapman-Kolmogorov equation. (10)
   (B) Write short notes on the following special distributions (10)
     i) Poisson distribution ii) Rayleigh distribution and iii) Gaussian distribution.

5. (A) Suppose X and Y are two random variables. Define covariance and correlation of X and Y. When do we say that X and Y are (10)
     (i) Orthogonal
     (ii) Independent and
     (iii) Uncorrelated? Are uncorrelated variables independent?
   (B) What is a Random Process? State four classes of random processes giving one example each. (10)

6. (A) Explain power spectral density function. State its important properties and prove any one of the property. (10)
   (B) Prove that if input to LTI system is w.s.s. then the output is also w.s.s. (10)

7. (A) Define Central Limit Theorem and give its significance. (5)
   (B) Describe sequence of random variables. (05)
   (C) A stationary process is given by $X(t) = 10 \cos [100 t + \theta]$ where θ is a random variable with uniform probability distribution in the interval $[-\pi, \pi]$. Show that it is a wide sense stationary process. (10)

(3 Hours) [Total Marks : 100

N.B. : (1) Question No.1 is **compulsory**.

(2) Answer any **four** questions out of remaining **six** questions.

(3) **Figures** to the **right** indicates **full** marks.

(4) Illustrate the answers with sketches wherever **required**.

Q.1. (a) Compare open & closed loop control system & give the example 5

(b) Define sensitivity. How can we reduce the sensitivity of closed loop system? 5

(c) Compare the two stability methods: 5

  (i) Root Locus (ii) Routh's criterion

(d) Give the advantages of Nyquist plot 5

Q. 2. (a) Consider the RLC network shown in figure below :- 10

Fig 2(a)
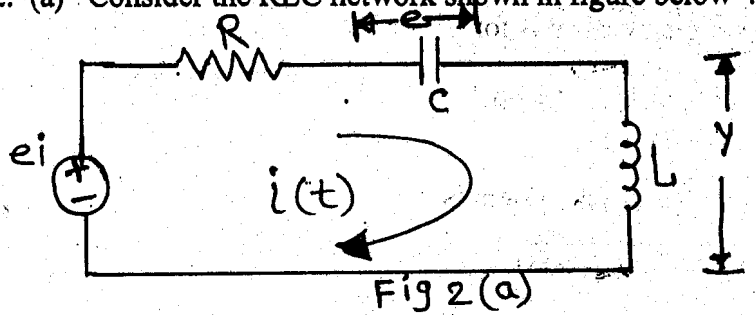
(i) obtain its transfer function model.

(ii) obtain its state space variable model.

(b) For a unity feedback system , $G(s) = \frac{200}{S(S+2)}$. 10

Find the time domain specification for a unit step input.

Q.3. (a) Using the block diagram reduction method , obtain the transfer function of the given system. 10

Fig 3(a)
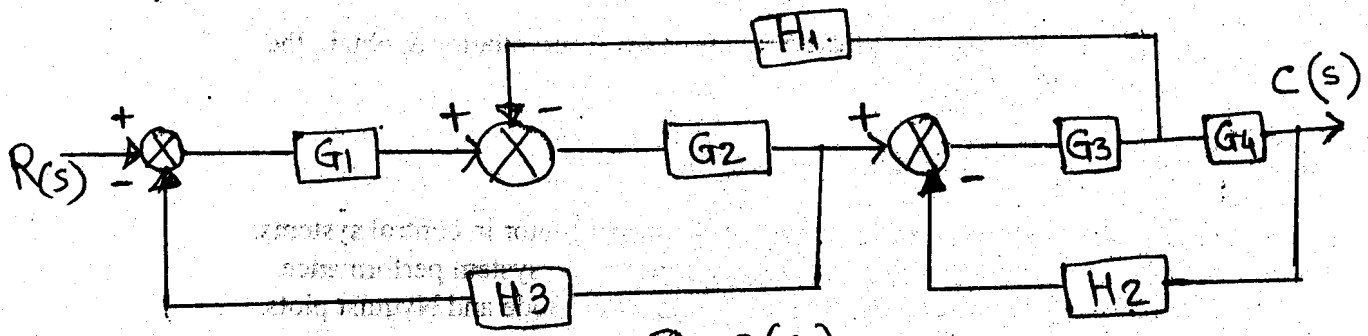
(b) Derive & analyze the response of a second order system to a unit step input. With the help of graphical plot explain the significance of damping ratio for the various values. 10

[TURN OVER

Q. 4. (a) For the signal flow graph, find the transfer function using Mason's gain formula.   10
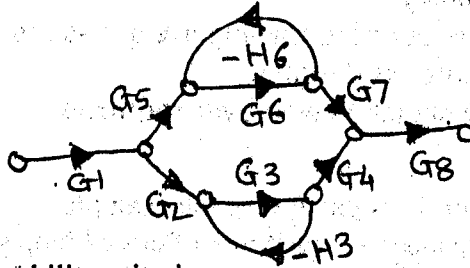

fig 4(a)

(b) Using Routh's stability criterion :-   10

     (i)   Find the range of K for stability of given system & frequency of oscillations

$$s^4 + 22s^3 + 10s^2 + s + K = 0$$

(ii) Determine the number of roots on imaginary axis for

$$s^5 + 6s^4 + 15s^3 + 30s^2 + 44s + 24 = 0.$$

Q.5. (a) The open loop transfer function of a feedback system is   10
$$G(s)H(s) = \frac{K}{S(S+1)(S+3)(S+4)}$$
Draw the complete root locus.

(b) Consider the feedback system with following open loop transfer function   10

$$G(s)H(s) = \frac{K}{S(S+3)(S+5)}$$ using Nyquist stability criterion,
find out whether the closed loop system is stable or not with K=1 .

Q. 6. (a) Draw Bode plot for the open loop transfer function. Indicate gain & phase   10
Margin.
$$G(s) = = \frac{1}{S(S+1)(S+5)}$$

(b) Derive the transfer of a armature controlled dc servomotor & obtain the   10
resulting block diagram.

Q. 7. Write short note on (any two):-   20

(a) Stepper motor construction and use of stepper motor in control systems.
(b) Error compensation methods and their effects on system performance.
(c) Finding stability gain and phase margins using Bode and Nyquist plots.

X

Con. 6886-11.   **MP-3790**

(2 Hours)   [**Total Marks : 50**

N.B. : (1) Question No. **1** is **compulsory**.
  (2) Attempt any **four** questions out of remaining **six** questions.
  (3) Assume **suitable** data wherever **necessary**.

1. Solve any **five** :–   **10**
  (a) What are 3R ? Explain.
  (b) What is acid rain ? Give effects of acid rain.
  (c) What is effect of mining on environment ?
  (d) Define Ecology and Ecosystem.
  (e) How pesticides contributes to water pollution ? Explain.
  (f) Write note on Disaster Management.
  (g) Differentiate between Exponential and Geometrical population growth.

2. (a) Explain soil erosion. Give its causes and types.   **5**
  (b) Describe the grassland and forest ecosystem.   **5**

3. (a) What is the need for public awareness and participation in the environmental   **5**
      education ?
  (b) Discuss rain water harvesting. What are advantages from this techniques ?   **5**

4. (a) Write an essay on 'Biological diversity'.   **5**
  (b) Classify the natural resources and explain reasons for their depletion.   **5**

5. (a) Explain 'Sustainable development'.   **5**
  (b) 'Information Technology plays an important role in environmental studies',   **5**
      explain.

6. (a) What is pollution ? Explain various types of pollution.   **5**
  (b) Discuss sailent features of :–   **5**
      (i) Wild Life (Protection) Act, 1972
      (ii) Forest (Conservation) Act, 1980.

7. (a) Explain the fundamental principles of environment.   **5**
  (b) Explain Cyclone mitigation and Ozone layer depletion.   **5**

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TE EXTC sem -Ⅵ
mᵖmc-I

Con. 6162-11.

MP-3898

(3 Hours)

[Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.

(2) Solve any **four** questions out of remaining **six** questions.

(3) Figures to the **right** indicate **full** marks.

(4) Assume **suitable** data if **necessary**.

1. (a) Explain I/o mapped I/o and memory mapped I/o. 5

(b) Explain T–states, Machine cycles and Instruction cycles. 5

(c) Explain internal memory organization of 8051. 5

(d) Describe addressing modes of ARM processor. 5

2. (a) Explain serial communication in 8085 system. 10

(b) Draw the timing diagram of XTHL instruction. 10

3. (a) Explain interrupt structure of 8085 microprocessor. 10

(b) Write an Assembly Language program to generate square wave of 1 kHz 10
using 8255.

4. (a) Draw and explain internal memory organization of 8051. 10

(b) Draw and explain the formats of interrupt enable SFR and Interrupt priority 10
SFR of 8051.

5. (a) Explain the following instructions of ARM processor : 10
MLA
QADD Rd, Rm, Rn
SMULL
LSL
CMP R0, R1

(b) Draw and explain the architecture of ARM processor. 10

6. (a) Write a program to arrange given set of numbers in ascending order. 10

(b) Explain 8253 control register format and generate control word to set counter-0 10
in mode 3 with BCD counting and loading only LSB count.

7. (a) Compare power down and idle mode of 8051. 5

(b) Compare features of 89C51, 89C53, 89C2051, 89C2052. 5

(c) Explain modes of 8259. 5

(d) Write an assembly Language program to turn on and off LED connected to 5
PC5 of port C of 8255 using BSR mode.