[Time: 3 Hours]   **[Marks:80]**

Please check whether you have got the right question paper.

N.B: 1. Question No.l is compulsory.
         2. Attempt any three questions from remaining five questions
         3. Draw neat diagrams wherever required
         4. Assume suitable data if necessary.

1   Attempt **any five.**   **20**
   a) What is live zero and dead zero concept?
   b) What is use of square root extractor in the process?
   c) Brief the flapper-nozzle system.
   d) Describe FTO and FTC control valves.
   e) Explain RFID with suitable example.
   f) Draw and Explain meter-out bypass speed control method for hydraulic circuit.

2.   a) lliustrate and describe SMART transmitter. State its advantages over convent   **10**
                ional transmitters.
         b) Compare Pneumatic, Hydraulic and Electric systems.   **10**

3.   a) List down selection criteria for Control valves used in industrial application.   **10**
         b) Explain various types of directional control valves used in pneumatic systems. **10**

4.   a) Draw and explain control valve characteristics in detail.   **10**
         b) Explain following switches with suitable diagram :   **10**
             Toggle switch, Push button, DIP and Rotary switch.

5.   a) Give classification of relays and explain Electromechanical Relay in detail.   **10**
         b) Classify control valves based on various parameters. Explain Globe valve with   **10**
             suitable sketch .

6.   Write a short note on :-   **20**
   a) Synchros
   b) Solid State Relay
   c) I to P convertor
   d) Thermostats

[3 Hours]   **[Total Marks: 80]**

Please check whether you have got the right question paper.

N.B: 1.   Question No. 1 is compulsory & solve any three questions from question no. 2 to 6.

         2.   Assume suitable data if required.

1.   Solve **any four** questions.   **20**
   - (a)   State and prove convolution property of Laplace transform.
   - (b)   Explain Dirichlet conditions for existence of fourier series.
   - (c)   Sketch
     1) $x(t) = r(t) - r(t-1) + 2u((t-2) - u(t-3) - 2u(t-4)$
   - (d)   Find whether $x(n) = \cos(0{\cdot}01\pi n)$ is period If it is find its fundamental period.
   - (e)   Find Z transform of following signal & state ROC
     1) $x(n) = 1, 2, 1, 5 \quad 2$
        $\qquad\qquad \uparrow$
     2) $x(n) = 1, 2 \quad 3 \ 1 \ 4$
        $\qquad\qquad\qquad \uparrow$

2.   (a)   A system which in turn is formed by interconnection of simple subsystems as shown below. Consider the square root operation produces only positive square root   **10**

   Find :   1) Relation between y(t) and x(t)
           2) Linearity of the system
           3)   Time invariance
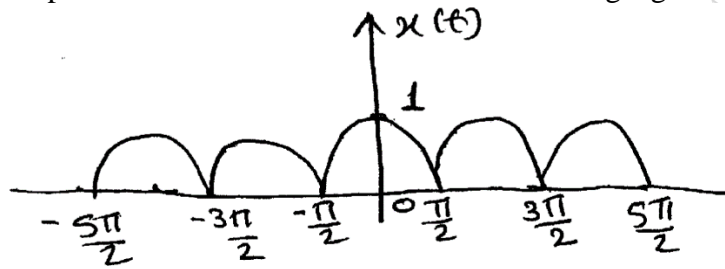   4)   Causality of total system.
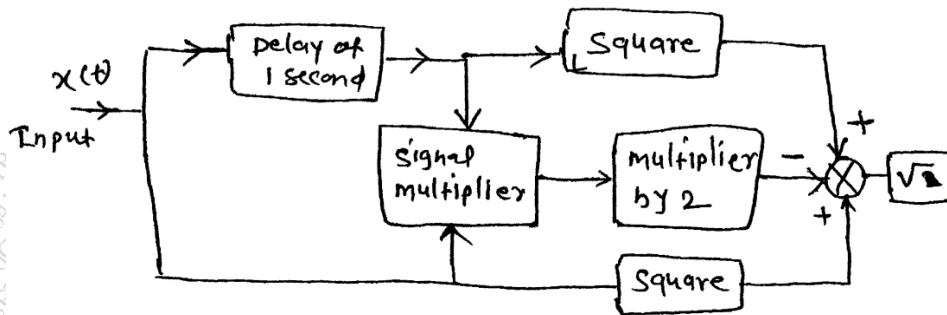
   - (b)   Find the fourier transform of SINC function.   **5**
   - (c)   Show that   **5**
     $x(t) * \delta(t - t0) = x(t - t0)$

3.   (a)   If $x(t) = 1$ for $-2 \le t \le 2$ **10**
            $= 0$ otherwise
          $h(t) = 2$ for $0 \le t \le 2$
      Find convolution between x(t) and h(t)

(b) Find exponential form of Fourier series of following signal. **10**

4. (a) Find the Laplace transform of **04**
$x(t) = 3e^{-2t} u(t) - 2e^{-t}u(t)$ & sketch ROC

(b) Find Inverse Laplace transform of **08**
$$H(s) = \frac{S+3}{(S+1)(S+2)} \text{ for RDC}$$

1. $Re\ (s) > -1$
2. $Re\ (s) < -2$

(c) Obtain the Z transform of **08**

I. $x(n) = n\ u(n)$

II. $x(n) = \left(\frac{1}{2}\right)^n u(n) - \left(\frac{1}{2}\right)^n u(n-10)$

5. LTI system is described by **10**

(a) $$y(n) - \frac{3}{4} y(n-1) + \frac{1}{8} Y(n-2) = x(n)$$

Determine Impulse response and step response

(b) Explain Parsewal's theorem. **05**

(c) If x(n) = 1, 2, 1, −1 **05**
↑

h(n) = 2, 1, 2, 2
↓

Find convolution of x(n) and h(n)

6. (a) Find Inverse Z transform of **10**
$$X(z) = \frac{1}{(z-1)(z-0.5)} \text{ for ROC}$$

I. $|z| > 1$
II. $|z| < 0.5$
III. $0.5 < |z| < 1$

(b) Differential equation of the system is given by **10**
$$\frac{d^2 y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 3\frac{dx(t)}{dt} + 9x(t)$$

Find 1) Transfer function of the system
II) Impulse response of the system.