Q.P. Code :22707

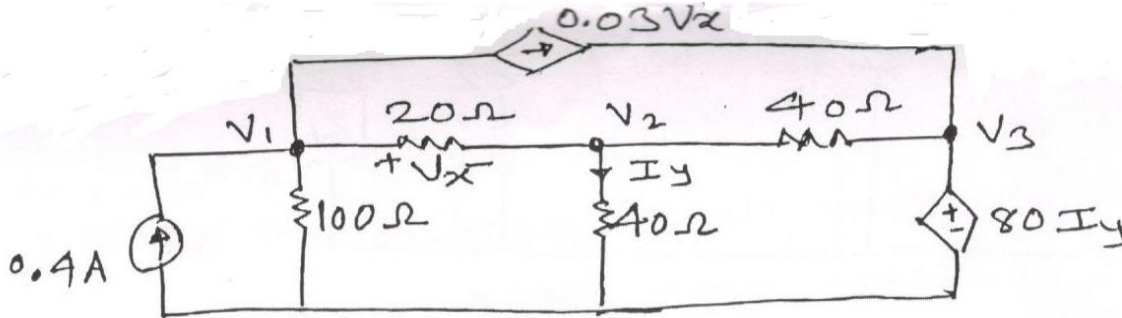[Time: Three Hours]   [Marks:80]

Please check whether you have got the right question paper.

N.B: 1. Question.No.1 is compulsory.
        2. Attempt any three questions out of the remaining five questions.
        3. Figures to the right indicate full marks.
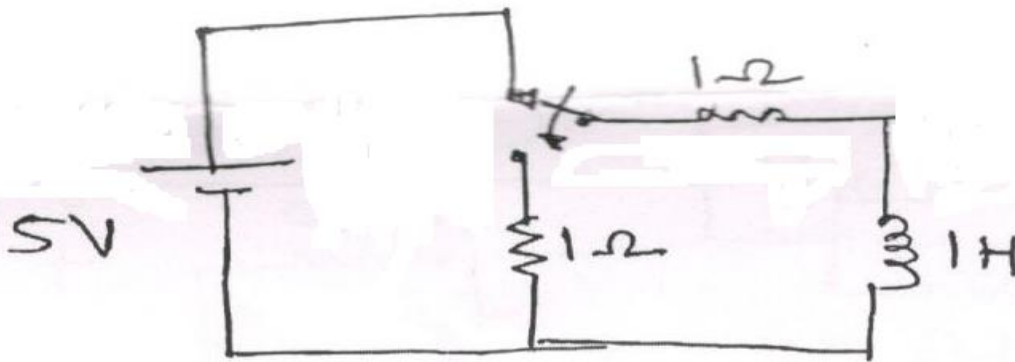   4. Assume suitable data wherever required but justify the same.

Q.1   a) For the circuit shown in fig. find v_1 and v_2 using Nodal Analysis.   05

b) Find i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t= O⁺ for the Network   05
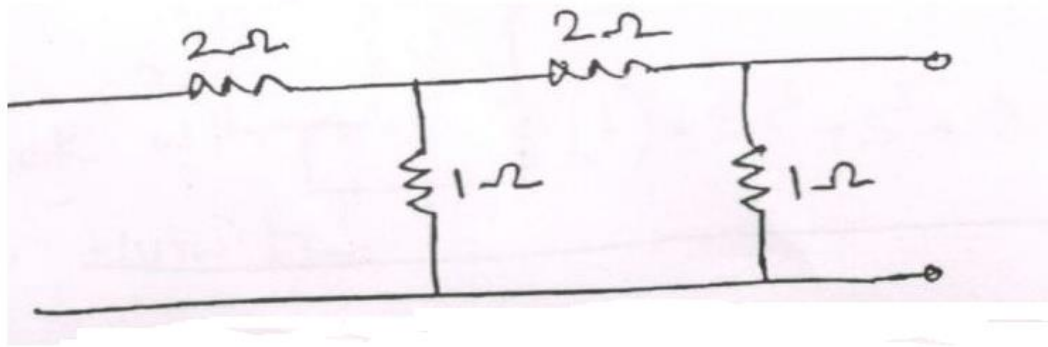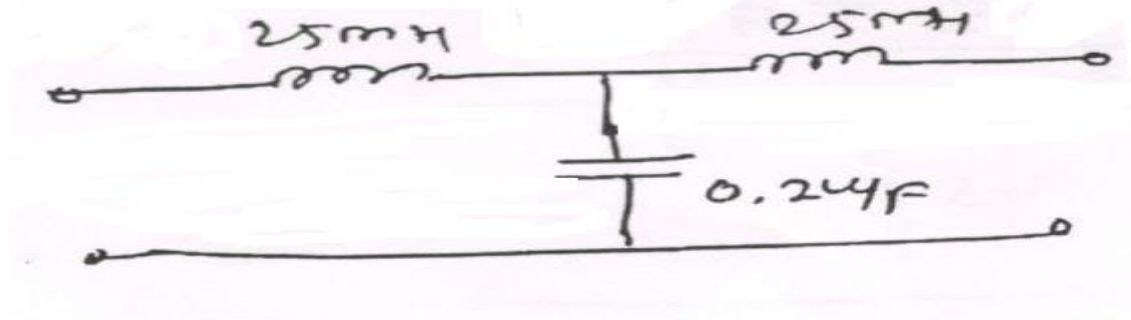
c) Determine h parameters of the network given. 05

d) Find nominal impedance, cut-off frequency and passband for the network shown. 05

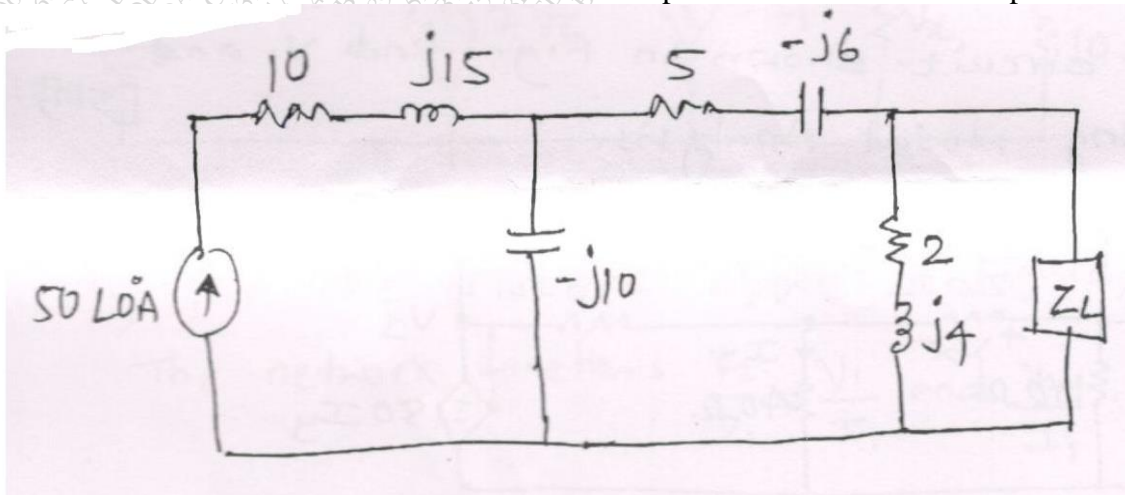Q.2 a) Find out value of Z_L that will receive the maximum power. Also determine the power 08

b) For the network shown in Fig. prove that the input impedance of port 1 is $|\Omega$ and also find the **08** voltage Transfer function.
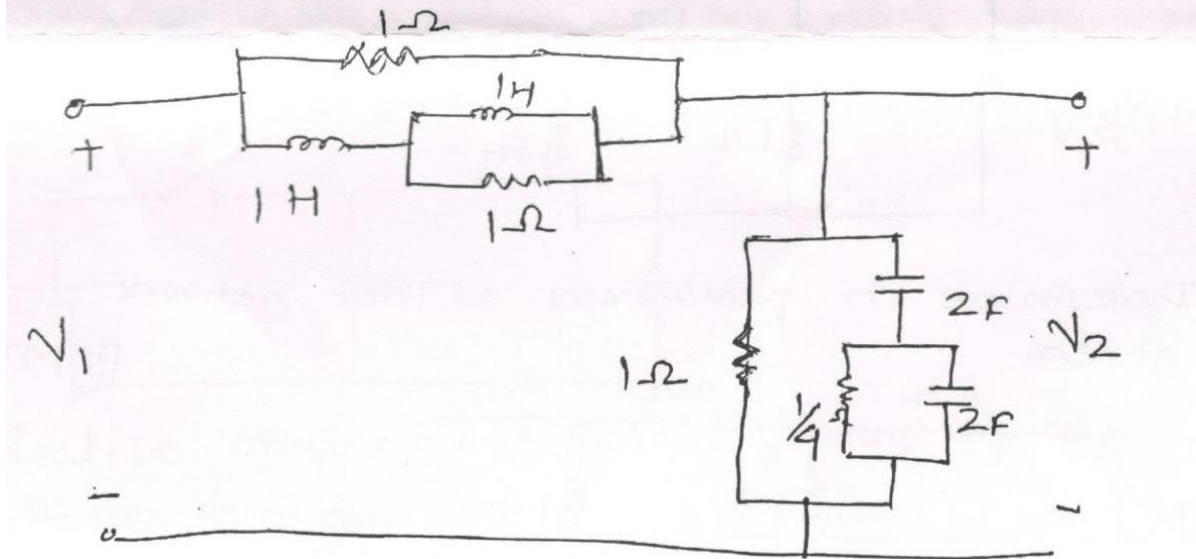
c) Test whether gives Function F(s) is positive Real function or Not. **04**

$$f(s) = \frac{s^3 + 6 s^2 + 7 s + 3}{s^2 + 2s + 1}$$

Q.3 a) Derive condition for reciprocity in terms of Z parameters and symmetry in terms of H parameters **10**

b) Design constant K-low pass filtes using π section having cut-off frequency of 4KHz and nominal impedance of 500 Ω. For the designed circuit, find characteristics impedance, Attenuation constant and phase constant at 2000 Hz and 6000 Hz **10**

Q.4 a) Find the voltage across the 15 Ω resister in figure using mesh analysis. **08**
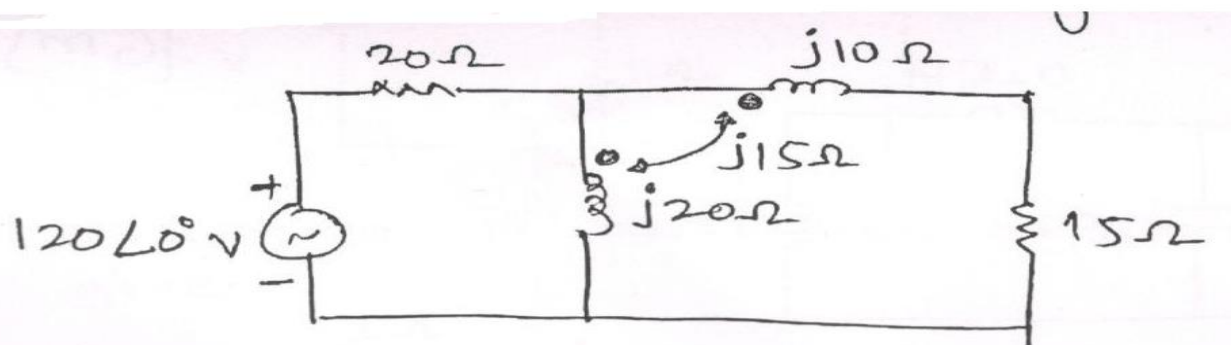
b) Check whether $P(s) = 2s^6 + s^5 + 12s^4 + 6s^3 + 56s^2 + 25s + 25$ is Hurwitz. 06

c) Find poles and zertos of the impedance of the network shown and plot them on the S-Plane 06
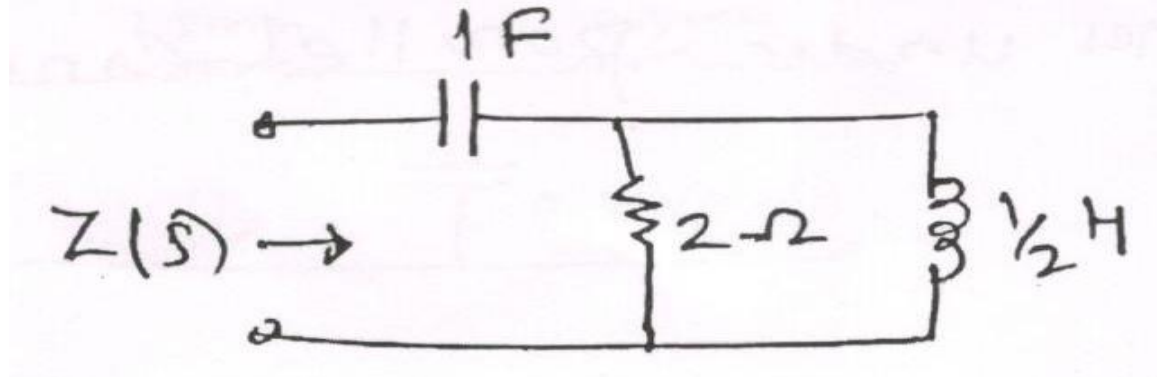
Q.5   a) Find current Through 10 Ω resistor using Norton's Theorem. 10
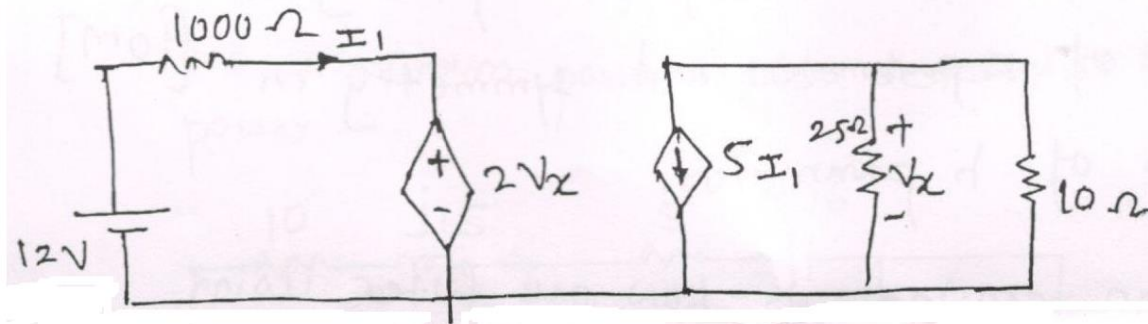
b) For the network shown in figure, find the network function's $\frac{V_2}{V_1}$, $\frac{V_1}{I_1}$ and $\frac{V_2}{I_1}$ 10
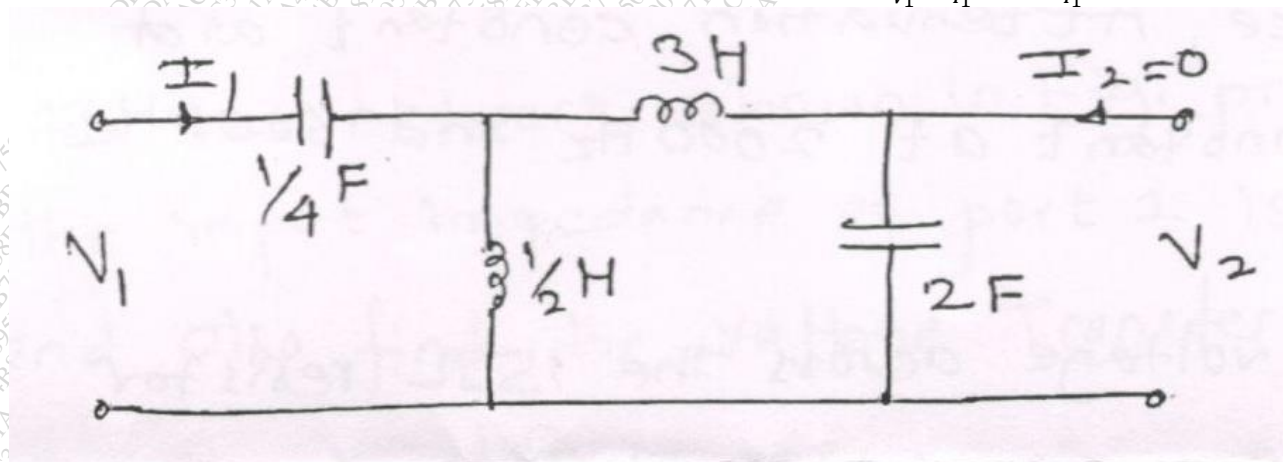
Q.6   a) Find i(t)   06
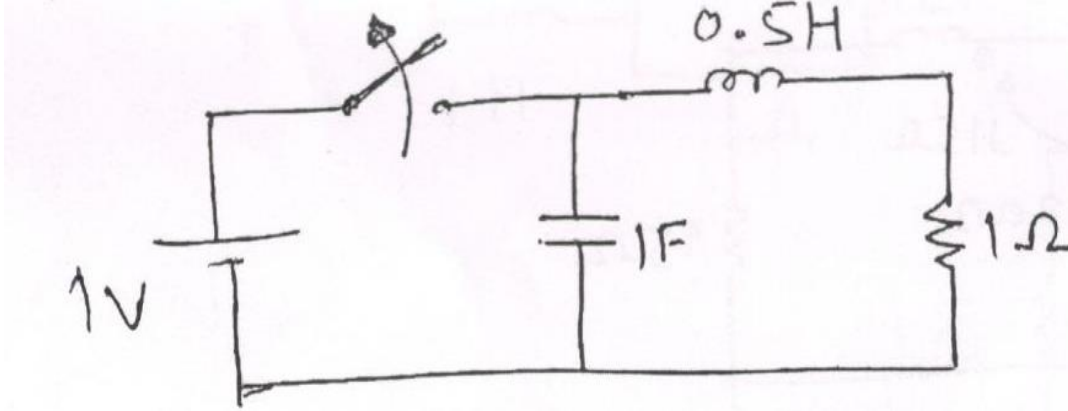
        b) Realise Fostes I and Fostes II form of the following function. $Z(s) = \frac{2(s+2)(s+4)}{(s+1)(S+3)}$ 08

        c) Derive the relation between the input and output questions of the two interconnected 2-part   06
networks under parallel Connection

(3 Hours)   **[Total marks : 80**

Note   : -   1) Question number **1** is **compulsory.**
                 2) Attempt any **three** questions from the remaining **five** questions.
                 3) **Figures** to the **right** indicate **full** marks.

Q.1   a)   Find the Laplace transform of $sinh^5 t$.   05

       b)   Find an analytic function whose imaginary part is   05
          $e^{-x}(y \cos y - x sin y)$.

       c)   Find the Fourier series for $f(x) = 1 - x^2$ in $(-1, 1)$.   05

       d)   Evaluate $\int_C \bar{F} \cdot d\bar{r}$ where $\bar{F} = 2x\,i + (xz - y)\,j + 2z\,k$ from   05
          $O(0, 0, 0)$ to $P(3, 1, 2)$ along the line OP.

Q.2   a)   Find a cosine series of period 2π to represent $\sin x$ in $0 \le x \le \pi$.   06

       b)   Find a, b, c if $\bar{F} = (axy + bz^3)\,i + (3x^2 - cz)\,j + (3xz^2 - y)\,k$ 06
          is irrotational.

       c)   Find the image of the circle $|z| = k$ where k is real under the bilinear   08
          transformation $w = \frac{5-4z}{4z-3}$.

Q. 3   a)   Prove that $J_{\frac{1}{2}}(x) = \tan x \cdot J_{-\frac{1}{2}}(x)$.   06

       b)   Find the inverse Laplace transform of the following function by   06
          convolution theorem
          $\frac{(s+2)^2}{(s^2+4s+8)^2}$.

       c)   Obtain the complex form of Fourier series for $f(x) = e^{ax}$ in $(-l, l)$ 08
          where a is not an integer.

Q. 4   a)   Find the angle between the normals to the surface $xy = z^2$ at the points   06
          $(1, \ 4, \ 2)$ and $(-3, \ -3, \ 3)$.

       b)   Prove that   06
          $x^2 J_n{}''(x) = (n^2 - n - x^2) J_n(x) + x J_{n+1}(x)$;
          $n = 0, 1, 2, \ldots\ldots$

c)

(i)   Find the Laplace transform of $sinhat \sin at$. 04

(ii) Find the Laplace transform of $te^{-4t} \sin 3t$. 04

Q. 5 a) Prove that $J_2(x) = J''_0(x) - \frac{J_0'(x)}{x}$. 06

b) If $v = e^x \sin y$, show that v is harmonic and find the corresponding analytic function. 06

c) Find the Fourier series for $f(x)$ in $(0, 2\pi)$,
$$f(x) = \begin{cases} x, & 0 < x \le \pi \\ 2\pi - x, & \pi \le x < 2\pi \end{cases}$$
Hence, deduce that
$$\frac{\pi^4}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \ldots\ldots$$ 08

Q. 6 a) Show that the set of functions $\cos nx, \quad n = 1, 2, 3, \ldots$ is orthogonal on $(0, 2\pi)$. 06

b) Using Green's theorem evaluate $\int_C \bar{F} \cdot d\bar{r}$ where C is the curve enclosing the region bounded by $y^2 = 4ax, x = a$ in the plane $z = 0$ and
$$\bar{F} = (2x^2y + 3z^2)\, i + (x^2 + 4yz)\, j + (2y^2 + 6xz)\, k.$$ 06

c) Use Laplace transform to solve 08

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 1 \text{ with } y(0) = 0, y'(0) = 1.$$

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Duration: 3 Hours   **Marks: 80**

Instructions:
  (1) **Question 1 is compulsory, solve any three from remaining questions**
  (2) **Assume suitable data if necessary.**
  (3) **Diagrams to be drawn neatly.**

Solve any **TWO** of the following--

Q1(A) Draw and explain energy band diagrams of P-N junction under forward   10
bias, reverse bias conditions.

Q1(B) Explain construction, working and characteristics of JFET   10

Q1(C) Explain construction, working and characteristics of SCR
10

Derive the expression of built in potential Vbi for a P-N junction under
Q2(A) zero bias and hence calculate Vbi at T = 300 K for Nd $=10^{15}$cm^{-3} and Na
$=10^{15}$cm^{-3}.   10

Q2(B) Explain any two applications of JFET.   10

Q3(A) Explain construction, working and characteristics of Enhancement   10
MOSFET.

Q3(B) Draw and explain Capacitance-voltage characteristics of MOS capacitor.   10

Q4(A) Explain construction, working, characteristics of
(i)Photodiode   (ii)Avalanche photodiode.   10

10
Q4(B) Explain construction and characteristics of Triac.

Q5(A)   List Nonideal effects in BJT.Explain in detail any one of them.   10

Q5(B)   Draw and explain any two models of BJT.   10

Solve any **TWO** of the following.

Q6(A)   Gunn diode.   10

Q6(B)   Breakdown mechanisms in zener diode.   10

Q6(C)   Two terminal MOS structre.   10

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

Please check whether you have got the right question paper.
**N.B:**   1.   **Question no. 1 is compulsory.**
                 2.   **Attempt any three out of the remaining five questions.**
                 3.   **Use suitable data, wherever necessary**

Q1   Attempt (**any 4**)
           A. Implement EX-OR gate using only NAND gates.   **05**
           B. Explain FAN in, FAN out, power dissipation and noise immunity with reference to **05**
                Digital lC's.   **05**
           C. Explain glitch problem of ripple counter.   **05**
           D. Write a note on VHDL Framework.   **05**
           E. Draw the truth table and logic diagram of Full Subtractor.

Q2 A Draw a circuit diagram of two input TIL NAND gate and explain its operation.   **10**

     B   Design 4 bit Johnson counter using J-K Flip Flop. Explain it operation using waveform.   **10**

Q3 A   Design a circuit with optimum utilization of PLA to implement the following functions.   **10**
           F1= Σm(0,2,5,8,9,11)
           F2= Σm (1,3,8,10,13,15)
           F3= Σm(0,1,5,7,9,12,14)
     B Eliminate redundant states and draw reduced state diagram.   **10**

PS	NS		O/P
	X=0	X=1	Y
A	B	C	1
B	D	F	1
C	F	E	0
D	B	G	1
E	F	C	0
F	E	D	0
G	F	G	0

Q4 A Implement the function using single IC 74151 and some gates.   **10**
           F=Σm(1,2,4,7,10,13,14)

                                                                                                                                  10

     B Design asynchronous Mod-8 counter using T-Flip flop.

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Q5 A Analyze the sequential state machine shown in figure. Obtain state diagram for the same.

10

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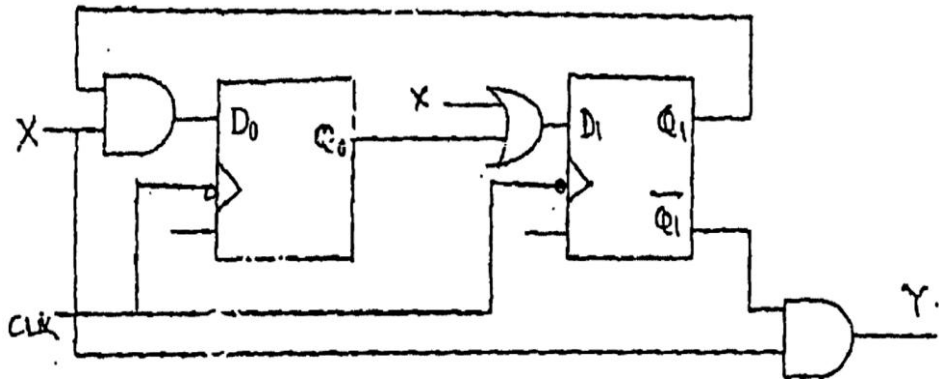
B) Design a mod-16 up counter using IC 74163, draw the circuit diagram and explain its working.

10

Q6   Write notes on.

20

1. Stuck at '0' and Stuck at '1' faults.
2. XC 4000 FPGA Architecture
3. Master Slave JK Flip Flop
4. Mealy and Moore Sequential Machine

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Time: 3 Hrs   **Marks: 80**

Que 1.   Attempt ant four

a.   Draw Hay's bridge. List applications of it.   **5**

b.   List static and dynamic characteristics of instruments   **5**

c.   Explain Generalized data acquisition system in brief   **5**

d.   Draw front panel of CRO   **5**

e.   List different types of transducers with their applications   **5**

Que 2.   Attempt the following

a.   Draw and Explain Ultrasonic transducer for level measurement   **10**

b.   Draw and Explain LVDT .Write advantages, disadvantages and
     applications of it.   **10**

Que 3.   Attempt the following

a.   List flow meters. Draw and Explain magnetic flow meter. What are its
     limitations?   **10**

b.   Compare RTD ,thermocouple and thermistor with construction ,working
     and applications   **10**

Que 4.   Attempt the following

a.   Draw and Explain Kelvin double bridge for resistance measurement. Write
     advantages of it.   **10**

b.   Draw and Explain Schering bridge for capacitance measurement   **10**

Que 5.   Attempt the following

a.   Draw and Explain the measurement of phase and frequency with Lissajous
     figures.   **10**

b.   Draw and Explain block diagram of CRO. Explain need of delay lines.   **10**

Que 6.   Attempt the following

a.   Data logger   **6**

b.   Strain gauge transducer   **8**

c.   FET type voltmeter   **6**

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