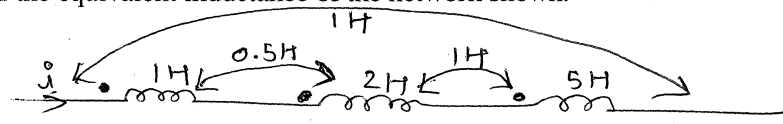
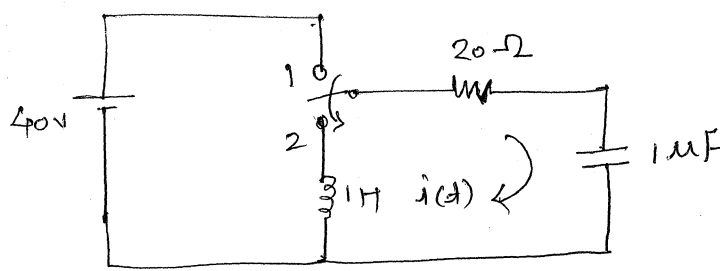
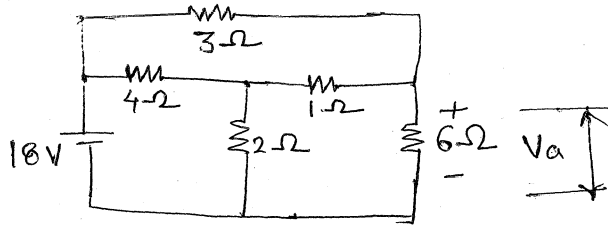


Note: 1) Question No.1 is compulsory.

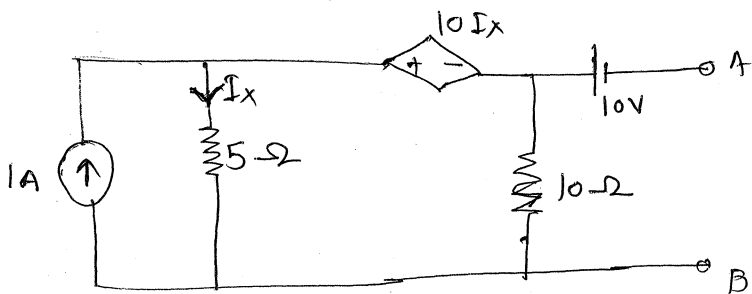
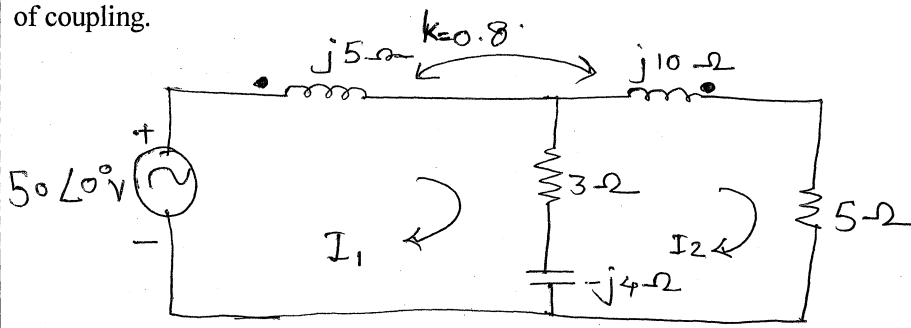
2) Attempt any three questions from remaining five questions.

3) Figures to the right indicate full marks.

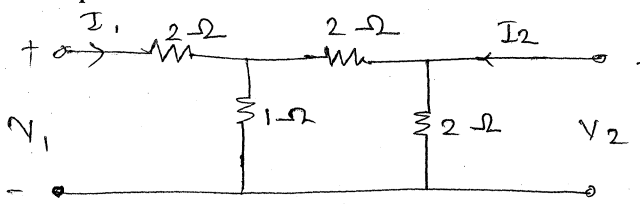
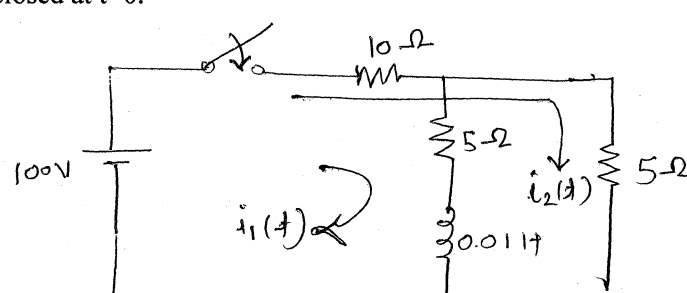
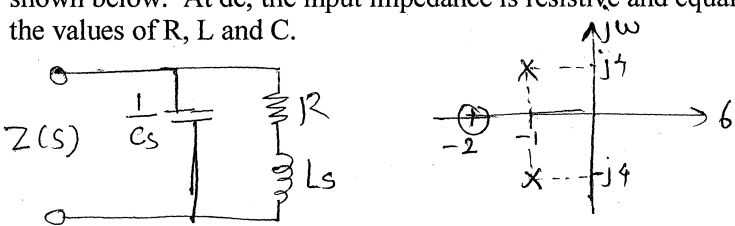
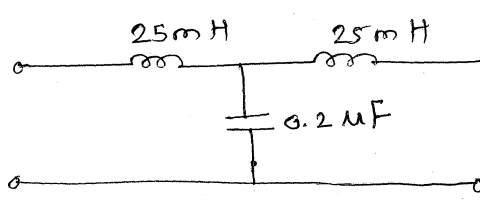
4) Use Smith Chart for transmission line problem.

	Solve the following questions.		
Q.1)	a)	Test for Hurwitz polynomial using Routh Hrwitz array $P(s) = S^8 + 5S^6 + 2S^4 + 3S^2 + 1$	5M
	b)	Check whether the given function is LC/RC/RL function. $F(s) = (s+2)(s+6)/2(s+1)(s+3)$	5M
	c)	Find VSWR and refection coefficient (Use Smith Chart) $Z_L = 2 + j2$	5M
	d)	Find the equivalent inductance of the network shown. 	5M
Q.2)	a)	In the network shown the switch is changed from the position 1 to the position 2 at $t=0$. Steady condition having reached before switching. Find the values i , di/dt and d^2i/dt^2 at $t=0^+$. 	8M
	b)	Calculate the voltage across resistor 6Ω using source shifting technique. 	8M
	c)	A coil of 20Ω resistance has an inductance of 0.2 H and connected in parallel with a condenser of $100\text{ }\mu\text{F}$ Capacitance. Calculate the frequency at which this circuit will have as a non-inductive resistance. Find also the value of dynamic resistance.	4M

TURN OVER

Q.3)	<p>a) What are standing waves? A transmission line has a characteristic impedance of 50Ω and terminated in a load $Z_L = 75 - j100 \Omega$. Find the following using a Smith chart a) VSWR b) Reflection coefficient c) input impedance at a distance 0.1λ from the load d) location of first voltage maximum and first voltage minimum from the load.</p>	8M
	<p>b) Find the Thevenin's equivalent of following network.</p> 	8M
	<p>c) Test for Hurwitz polynomial using continued fraction expansion method. $P(s) = S^4 + 7S^3 + 6S^2 + 21S + 8$</p>	4M
Q.4)	<p>a) Find the voltage across 5Ω resistor in the network shown below. $K=0.8$ coefficient of coupling.</p> 	8M
	<p>b) Test for positive real function</p> <p>i) $F(s) = \frac{s^3 + 6s^2 + 7s + 3}{s^2 + 2s + 1}$</p> <p>ii) $F(s) = \frac{s^2 + s + 6}{s^2 + s + 1}$</p>	12M

TURN OVER

<p>Q.5)</p>	<p>a) Two identical sections of the network shown are connected in cascade. Obtain the transmission parameters of the overall connection.</p> 	<p>10M</p>
	<p>b) In the network shown determine the currents $i_1(t)$ and $i_2(t)$ when the switch is closed at $t=0$.</p> 	<p>10M</p>
<p>Q.6)</p>	<p>a) Realize foster form I and foster form II for the following function.</p> $Z(s) = \frac{(s^2+1)(s^2+3)}{s(s^2+2)}$	<p>8M</p>
	<p>b) The pole zero diagram of the driving point impedance function of the network is shown below. At dc, the input impedance is resistive and equal to 2W. Determine the values of R, L and C.</p> 	<p>8M</p>
	<p>c) Find the nominal impedance, cut off frequency and pass band for the network shown.</p> 	<p>4M</p>

- NB : (1) Question No.1 is compulsory.
 (2) Out of remaining questions, attempt any three questions.
 (3) Assume suitable data, wherever necessary.

1. (a) Explain the term noise margin and its value for TTL and CMOS family. 5
 (b) Differentiate between synchronous and asynchronous counter. 5
 (c) Draw truth table and logic diagram of Full Adder. 5
 (d) Explain shift registers and its applications. 5

2. (a) Use k- map to reduce the following function and then implement it using NOR gates only. 10

$$F(ABCD) = \sum m(4,6,12,14) + \sum d(1,3,9,11)$$

 (b) Implement the following function using 8:1 MUX and logic gates. 10

$$P(A,B,C,D) = \sum m(1,2,5,8,10, 12,15) + \sum d(0,6)$$

3. (a) Design a mealy sequence detector to detect 1010 using D flip-flops and logic gates. 10
 (b) Design a MOD 5 asynchronous counter and explain the glitch problem. 10

4. (a) Design a circuit with optimum utilization of PLA to implement the following functions. 10

$$F1 = \sum m(2,12,13)$$

$$F2 = \sum m(7,8,9, 10, 11,12,13,14, 15)$$

$$F3 = \sum m(1,2,8,12,13)$$

 (b) Design 4 bit Johnson counter using J-K flip-flop. Explain its working using waveform. 10

5. (a) Eliminate redundant states and draw reduced state diagram. 10

Present State	Next State		Output	
	X = 0	X = 1	X = 0	X = 1
1	2	3	0	0
2	2	4	0	0
3	2	3	0	0
4	5	3	0	0
5	2	6	0	1
6	5	3	0	0

- (b) Discuss XC 4000 FPGA architecture with neat block diagram. 10

[TURN OVER

6. Write notes on :

20

- (a) VHDL
 - (b) Stuck at '0' stuck at '1' fault.
 - (c) Master slave JK flip-flop.
 - (d) BCD Adder.
-

(3 Hours)

Marks: 80

N.B: (1) Question No.1 is compulsory and solves any three questions from remaining questions.

(2) Assume suitable data if necessary.

(3) Draw neat and clean figures.

1. Answer any four:

- (a) What are non-ideal effects in BJT? Explain any one non ideal effect in BJT. 05
- (b) With neat diagram explain the operation of UJT relaxation oscillator. 05
- (c) Compare photodiode with phototransistor. 05
- (d) Explain two terminal MOS structure. 05
- (e) Explain zener diode application as voltage regulator. 05
2. (a) Explain concept, working and characteristics of Tunnel diode. 10
- (b) Explain working of BJT considering all possible current density components in an NPN transistor operating in Active mode. 10
3. (a) For a n channel JFET with $I_{DSS} = 8\text{mA}$, $V_p = -4\text{V}$ 10
- (i) If $I_D = 3\text{mA}$ calculate the value of V_{GS}
- (ii) Calculate $V_{DC(SAT)}$ for $I_D = 3\text{mA}$.
- (iii) Calculate transconductance (gm)
- (b) What is primary advantage of HBT over BJT? Draw and explain schematic cross section of an npn HBT structure with its energy band diagram when HBT is operated under active mode? 10
4. (a) Describe construction, working and characteristics of: 10
- i. SCR ii. IGBT
- (b) Discuss Ebers- Moll model for BJT in detail 10
5. (a) Explain JFET with the help of construction and V-I characteristics, how it is different than BJT. 10
- (b) Explain construction, working and characteristics of TRIAC 10
6. Write short notes 20
- (a) Optocoupler
- (b) Gunn diode
- (c) MESFET
- (d) Solar cell

(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) Evaluate $\int_0^{\infty} e^{-2t} \sin^2 2t dt$. 05
 - b) Find an analytic function $f(z) = u + iv$ where $u + v = e^x(\cos y + \sin y)$. 05
 - c) Obtain Fourier series of $x \cos x$ in $(-\pi, \pi)$. 05
 - d) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ where $\bar{F} = x^2 i + xy j$ from $(0, 0)$ to $(1, 1)$ along the parabola $y^2 = x$. 05
- Q.2
- a) Find half-range cosine series for $f(x) = e^x$, $0 < x < 1$. 06
 - b) Prove that $\bar{F} = (x + 2y + az) i + (bx - 3y - z) j + (4x + cy + 2z) k$ is solenoidal and determine the constants a, b, c if \bar{F} is irrotational. 06
 - c) Prove that $w = i \left(\frac{z-i}{z+i} \right)$ maps upper half of the z -plane into the interior of the unit circle in the w -plane. 08
- Q. 3
- a) Prove that $J_n(x)$ is an even function if n is even integer and is an odd function if n is odd integer. 06
 - b) Find the inverse Laplace transform of $\frac{s^2+2s+3}{(s^2+2s+5)(s^2+2s+2)}$. 06
 - c) Obtain the complex form of Fourier series for $f(x) = e^{ax}$ in $(0, a)$. 08
- Q. 4
- a) Prove that $\nabla f(r) = f'(r) \frac{\bar{r}}{r}$ and hence, find f if $\nabla f = 2r^4 \bar{r}$. 06
 - b) Prove that $4J''_n(x) = J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)$. 06

- c)
 (i) Find the Laplace transform of $e^{4t} \sin^3 t$. 04
 (ii) Find the Laplace transform of $t \sqrt{1 + \sin t}$. 04
- Q. 5 a) Prove that $\int x \cdot J_{\frac{2}{3}} \left(x^{\frac{3}{2}}\right) dx = -\frac{2}{3} x^{-\frac{1}{2}} J_{-\frac{1}{3}} \left(x^{\frac{3}{2}}\right)$. 06
 b) Find p if $f(z) = r^2 \cos 2\theta + i r^2 \sin p\theta$ is analytic. 06
 c) If $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2 - x), & 1 \leq x \leq 2 \end{cases}$ with period 2, show that 08

$$f(x) = \frac{\pi}{2} - \frac{4}{\pi} \sum_{n=0}^{\infty} \frac{1}{(2n+1)^2} \cos(2n+1)\pi x.$$
- Q. 6 a) Show that the set of functions $\cos nx$, $n = 1, 2, 3, \dots$ is orthogonal 06
 on $(0, 2\pi)$.
 b) Use Stoke's theorem to evaluate $\int_C \vec{F} \cdot d\vec{r}$ where 06
 $\vec{F} = (2x - y) i - yz^2 j - y^2 z k$ and S is the surface of hemisphere
 $x^2 + y^2 + z^2 = a^2$ lying above the xy -plane.
 c) Use Laplace transform to solve 08
 $\frac{d^2 y}{dt^2} + y = t$ with $y(0) = 1, y'(0) = 0$.

Duration: 3hrs

Max Marks: 80

Please check whether you have got the right question paper

- NB:** a) Question number 1 is compulsory
b) Attempt any **3** questions from remaining questions
c) Right hand side figures indicates marks

Que 1. Attempt any four questions

[20]

- Draw and Explain Components of Generalized measurement system.
- Explain Auto Ranging and Auto Zero Adjustments in Digital Instruments.
- Compare CRO and DSO.
- Explain Selection Criteria of Transducers.
- Draw and Explain Data logger.
- Draw and Explain Side glass tube method for level measurement.

Que 2. Attempt the following questions

[20]

- Explain different errors in measurement also explain how to eliminate/Reduce Errors.
- Draw and Explain Electronics Voltmeter using Transistors and FETs. Justify which one is suitable for voltage measurement.

Que 3. Attempt the following questions

[20]

- Draw and Explain Measurement of Inductance using Maxwell Bridge and Hey Bridge. Justify which one is suitable for inductance measurement.
- Draw and Explain Kelvin's Double Bridge for Low resistance measurement.

Que 4. Attempt the following questions

[20]

- Draw and Explain Experimental setup for measurement of Frequency and Phase using Lissajous Figures.
- Draw and Explain DSO with features like Roll, Refresh, Storage Mode and Sampling Rate also List applications of DSO.

Que 5. Attempt the following questions

[20]

- Draw and Explain Linear Variable Differential Transformer with its characteristics. List applications of it.
- Draw and Explain Rotameter for flow measurement.

Que 6. Attempt the following questions

[20]

- Draw and Explain Dead Weight Tester for pressure measurement.
- Draw and Explain PC based Instrumentation System.