ETRX/INST/EXTC

Paper / Subject Code: 49702 / APPLIED MATHEMATICS III | NOV-2018

Sem-III - CBSGS.

Q. P. Code : 37078

(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 $f(x) = \begin{cases} \pi x, & 0 \le x \le 1 \\ \pi(2-x), & 1 \le x \le 2 \end{cases}$ 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 $\cos nx,\ n = 1, 2, 3, \ldots..$ is orthogonal on $(0, 2\pi)$. 06

b) Use Stoke's theorem to evaluate $\int_C \bar{F} \cdot d\bar{r}$ where $\bar{F} = (2x - y)\, i - yz^2\, j - y^2 z\, k$ and S is the surface of hemisphere $x^2 + y^2 + z^2 = a^2$ lying above the xy −plane. 06

c) Use Laplace transform to solve 08

$\frac{d^2y}{dt^2} + y = t$ with $y(0) = 1, y'(0) = 0$.

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Sem-III - CBSGS | N-18.

(3 Hours) Marks : 80

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**

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6. Write notes on : 20

(a) VHDL

(b) Stuck at '0' stuck at '1' fault.

(c) Master slave JK flip-flop.

(d) BCD Adder.

ETRX / **Paper / Subject Code: 49704 / CIRCUIT THEORY** Nov – 2018.

Sem – III – CBSGS

Q. P. Code : 13673

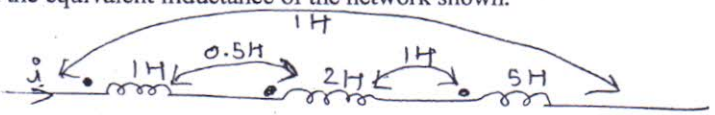
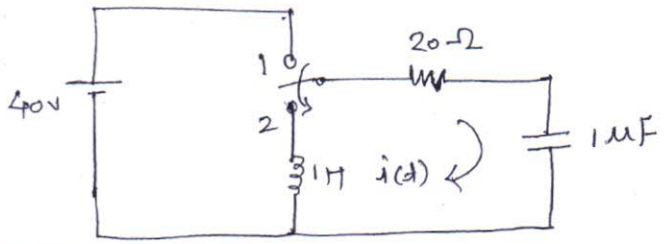
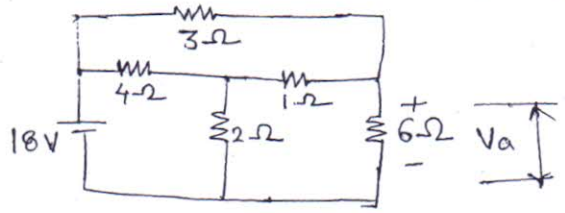
(3 Hours) [Total Marks : 80

Note: 1) Question No.1 is compulsory.

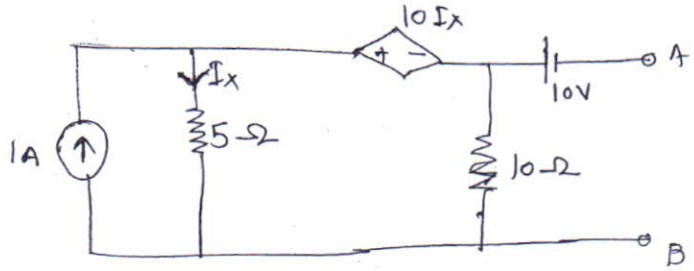
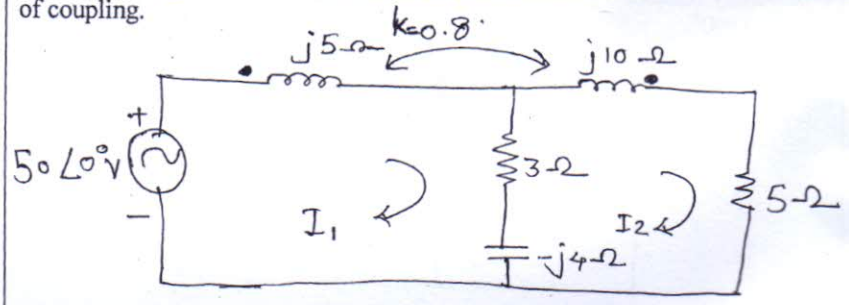
2) Attempt any three questions from remaining five questions.

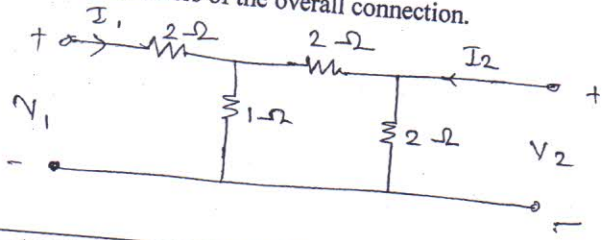
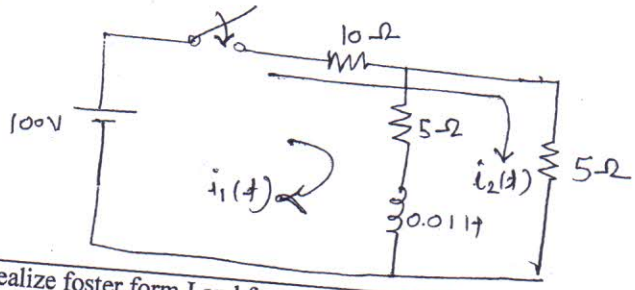
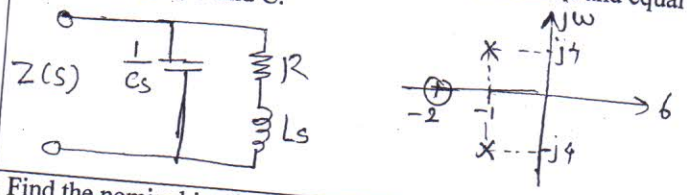
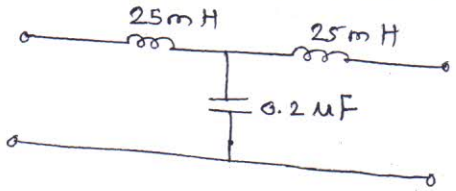
3) Figures to the right indicate full marks.

4) Use Smith Chart for transmission line problem.

Q.1)		Solve the following questions.	
	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 20 Ω resistance has an inductance of 0.2 H and connected in parallel with a condenser of 100 μF 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)	a)	What are standing waves? A transmission line has a characteristic impedance of 50 Ω and terminated in a load Z_L = 75-j100 Ω. 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.	8M
	b)	Find the Thevenin's equivalent of following network. 	8M
	c)	Test for Hurwitz polynomial using continued fraction expansion method. $P(s)= S^4+7S^3+6S^2+21S+8$	4M
Q.4)	a)	Find the voltage across 5Ω resistor in the network shown below. K=0.8 coefficient of coupling. 	8M
	b)	Test for positive real function i) $F(s)= \frac{s^3+6s^2+7s+3}{s^2+2s+1}$ ii) $F(s)= \frac{s^2+s+6}{s^2+s+1}$	12M

Q.5)	a)	Two identical sections of the network shown are connected in cascade. Obtain the transmission parameters of the overall connection. 	10M
	b)	In the network shown determine the currents $i_1(t)$ and $i_2(t)$ when the switch is closed at t=0. 	10M
Q.6)	a)	Realize foster form I and foster form II for the following function. $Z(s)=\frac{(s^2+1)(s^2+3)}{s(s^2+2)}$	8M
	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. 	8M
	c)	Find the nominal impedance, cut off frequency and pass band for the network shown. 	4M