Duration: 3hrs **Max. Marks:80**

NB:
(1) Question No.**1** is compulsory.
(2) Answer any **three** from remaining questions.
(3) **Figures** to the right indicate full marks.
(4) Assume suitable data if required.

Q.1 Attempt **any four**

a Compare JFET and MOSFET **5**

b Explain the Significance of stability factor **5**

c Why crystal oscillator is most stable oscillator? **5**

d Describe thermal runaway in BJT **5**

e What is clipping and clamping explain with one example. **5**

Q.2

a Draw BJT CE amplifier with any biasing circuit and derive expression for voltage gain, input impedance and output impedance. **10**

b What is Varctor diode? Explain construction and operation of varactor diode. **10**

Q.3

a Sketch the circuit of Wein Bridge Oscillator using BJT and derive an expression for the frequency of oscillation. **10**

b For Common source amplifier with N-channel E0MOSFET determine A_V, Zi, and Zo. V_{DD}=21V,R_1=42K,R_2=33K, R_D=5K, R_S=1.5K. The MOSFET parameters are: V_{TN}=1.5V, Kn=0.5mA/V^2 **10**

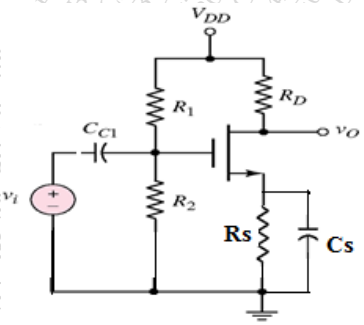

Fig.2

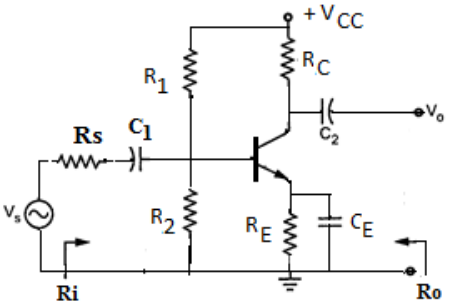

Fig.3

Q.4 a For the amplifier shown in Fig.3 analyze and determine. Derive the expression for small-signal voltage gain, input and output impedance. BJT and circuit parameters are: $\beta = 100, V_{BE} = 0.7V, V_A = 100V$ .R_1=93.7K, R_2=6.3k, R_C=6K, R_S=0.5K, V_{CC}=12V. **10**

b Draw the constructional diagram of N-Channel JFET, and explain the operation and thus obtain the V-I characteristics. **10**

Q.5

a An N-Channel FET with common drain amplifier shown in fig.4 has the following parameters: I_{DSS}=10mA, at V_P=-4V. Determine Small signal voltage gain, input impedance and output impedance. If R_1=10M, R_2=2M, V_{DD}=18V, R_S=1.2k, R_L=10K. **10**

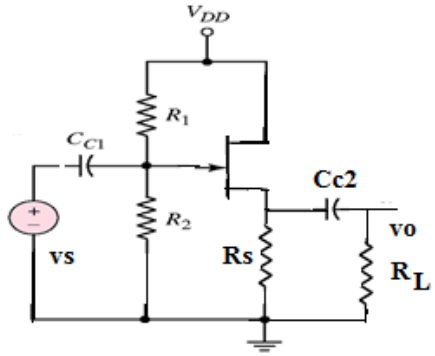

Fig.4

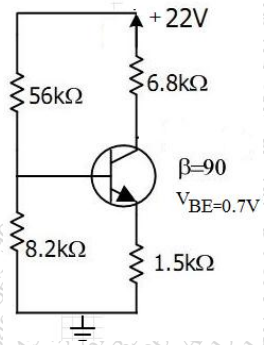

Fig.5

b For the circuit shown in figure 5. Determine Q point co-ordinates. **10**

Q.6 Attempt the following

a) LC oscillator and its application. **5**

b) Small signal h- parameter parameters of BJT **5**

c) Depletion MOSFET operation. **5**

d) Compare BJT and FET **5**

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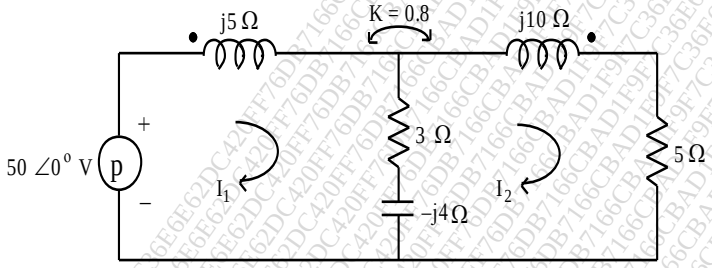
Q.P. Code : 50501

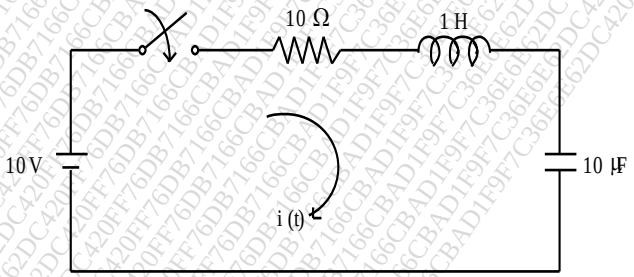
[Time: Three Hours] **[Marks:80]**

N.B.
1) Question No. 1 is Compulsory
2) Out of remaining questions, attempt any three
3) Assume suitable data if required
4) Figures to the right indicate full marks

1 (A) Draw equivalent circuit for given magnetically coupled circuit. 05

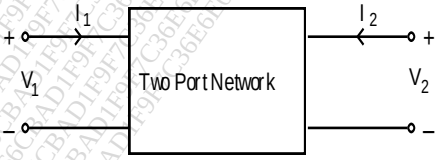


(B) In the network shown in Fig., switch is closed. Assuming all initial conditions as zero, find i and $\frac{di}{dt}$ at t = 0+. 05



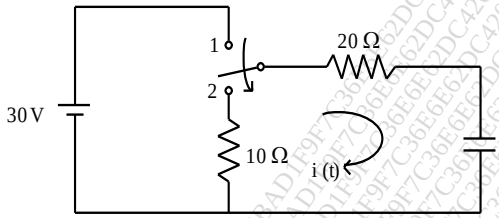
(C) In the two port network shown in Fig., compute h-parameters from the following data : 05

(a) With the output port short circuited : $V_1 = 25$ V, $I_1 = 1$ A, $I_2 = 2$ A
(b) With the input port open circuited : $V_1 = 10$ V, $V_2 = 50$ V, $I_2 = 2$ A

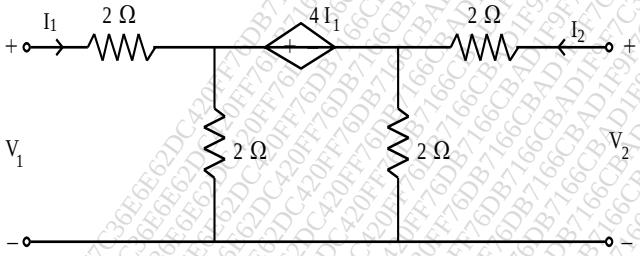


(D) Design an m-derived T section high pass filter with a cut-off frequency of 2 kHz. Design impedance of 700Ω and m = 0.6. 05

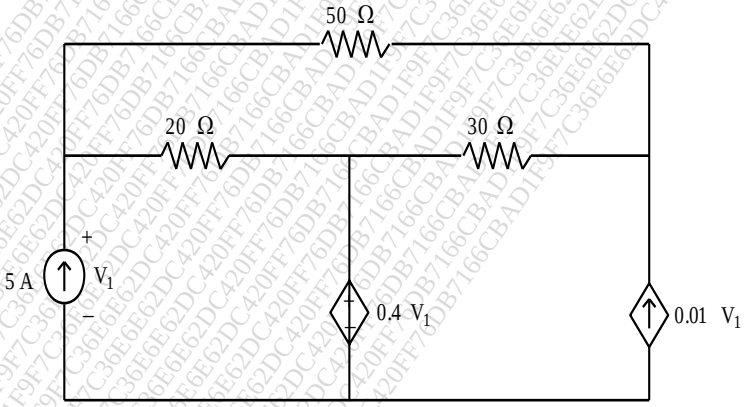
2 (A) In the network shown in Fig., switch is changed from position 1 to position 2 at t = 0, steady condition having reached before switching. Find the values of i, $\frac{di}{dt}$ and $\frac{d2i}{dt2}$ at t = 0+. 10



(B) Find Z and h-parameters for the network shown in Fig. 10



3 (A) Find the power supplied by the dependent voltage source. 10



(B) The parameters of a transmission lines are R = 65Ω/km, L=1.6mH/km, G = 2.25 mmho/km, C=0.1μF/km. Find 10

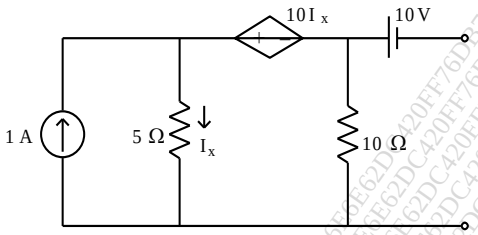
i) Characteristic Impedance
ii) Propagation Constant
iii) Attenuation Constant
iv) Phase Constant at 1 kHz

4 (A) Determine whether following functions are positive real 10

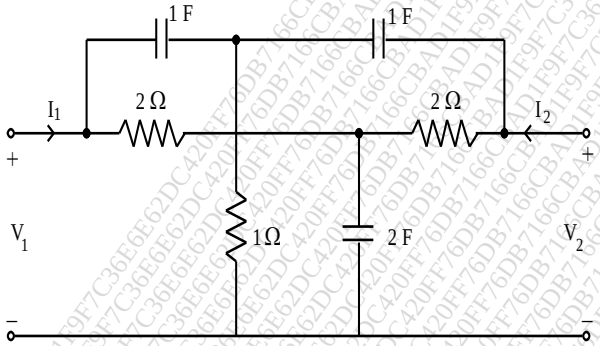
i) $\frac{s^4 + 3s^3 + s^2 + s + 2}{s^3 + s^2 + s + 1}$

ii) $\frac{s\,(s + 3)\,(s + 5)}{(s + 1)\,(s + 4)}$

(B) Obtain Thevenin equivalent network of Fig. 10



5 (A) Find Y-parameters for the network shown in Fig. 10

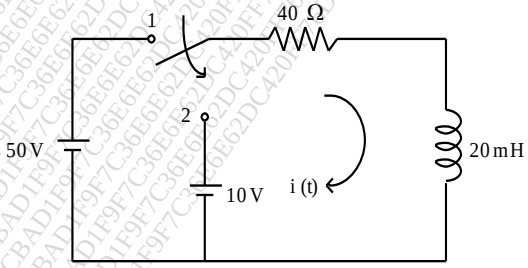


(B) Realize the following functions in Foster II and Cauer I form 10

$$Z(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$$

6 (A) A transmission line has a characteristics impedance of 50 ohm and terminate in a load Z_L= 25 + j50 ohm. Use smith chart and Find VSWR and Reflection coefficient at the load. 10

(B) The network of Fig. is under steady state with switch at position 1. At t = 0, switch is moved to position 2. Find i (t). 10



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(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 cost cos2t cos3t 05

b) Show that the set of functions cosnx, n= 1,2,3,……. is orthogonal over $(0 , 2\pi)$ 05

c) Prove that $f(z) = (x^3 – 3xy^2 + 2xy) + i(3x^2y – x^2 + y^2 – y^3)$ is analytic and find $f^I(z)$ in terms of z . 05

d) Find the directional derivative of $\varphi = x^2+y^2+z^2$ in the direction of the line $\frac{x}{3} = \frac{y}{4} = \frac{z}{5}$ at (1, 2, 3) 05

Q.2 a) Find the fourier series for $f(x) = x^2$ in $(0 , 2\pi)$ 06

b) Show that the vector $\bar{F} = (x^2 + xy^2)\, i + (y^2 + x^2y)\, j$ is irrotational and find its scalar potential 06

c) Prove that the transformation $w = \frac{1}{z+i}$ transforms real axis of z- plane into a circle of w – plane 08

Q.3 a) Using convolution theorem, find inverse Laplace transform of $\frac{s^2}{(s^2+2^2)^2}$. 06

b) Prove that $J_{5/2}(x) = \sqrt{\frac{2}{\pi x}}\left(\frac{3-x^2}{x^2}\sin x - \frac{3}{x}\cos x\right)$ 06

c) Find half range cosine series for $f(x) = x(\pi - x)$, $0<x<\pi$. Hence show that $\sum_1^\infty \frac{1}{n^4} = \frac{\pi^4}{90}$ 08

Q.4 a) Evaluate by Green's theorem $\int_c (e^{x^2} - xy)\,dx - (y^2 - ax)dy$ where c is the circle $x^2 + y^2 = a^2$. 06

b) Prove that $2J_0''(x) = J_2(X) - J_0(x)$. 06

c) i) Evaluate $\int_0^\infty \frac{e^{-t} - e^{-3t}}{t}$ dt 08

ii) Find Laplace transform of $t\sqrt{1 + sint}$

Q.5 a) Find the orthogonal trajectory of the family of curves $x^3y - xy^3 = c$. 06

b) Prove that $\int x \cdot J_{2/3}(x^{3/2})\,dx = -\frac{2}{3}x^{-1/2}J_{-1/3}(x^{3/2})$. 06

c) Obtain complex form of Fourier Series for $f(x) = e^{2x}$ in (0, 2). 08

Q.6 a) Use stoke's Theorem to evaluate $\int_c \bar{F} \cdot d\bar{r}$ where $\bar{F} = yz\,i + zx\,j + xy\,k$ and C is the boundary of the circle $x^2 + y^2 + z^2 = 1$ and $z = 0$. 06

b) Find the fourier integral representation for 06

$f(x) = e^{ax}$, $x \leq 0$, $a > 0$

$= e^{-ax}$, $x \geq 0$, $a > 0$

Hence show that $\int_0^\infty \frac{\cos wx}{w^2 + a^2}\,dx = \frac{\pi}{2a}e^{-ax}$, $x > 0$, $a > 0$

c) Solve using Laplace transform $(D^2 + 2D + 5)y = e^{-t}sint$, where $y(0) = 0$, $y'(0) = 1$. 08

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