Q. P. Code : 38831

(3 Hours) **(Total Marks : 80**

N.B. : (1) Question **No. 1 is compulsory**.
(2) Solve any **three** questions from the **remaining five**
(3) Figures to the right indicate full marks
(4) Assume suitable data if necessary and mention the same in answer sheet.

Q.1 Attempt **any 5** questions **[20]**

a) Draw switching characteristics of a diode and explain the reverse recovery time.

b) Calculate V_{CEQ} for the common base circuit shown in Fig. 1b if the transistor parameter is β=120

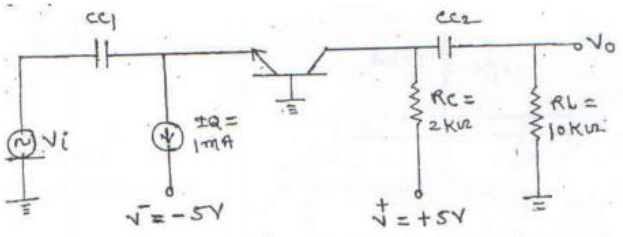

Fig. 1b

c) Draw small signal model of JFET and explain the significance of each parameter.

d) Compare CE, CB and CC configuration.

e) Draw small signal hybrid pi model of BJT including early effect.

f) What are the Barkhausean's criteria for sustained oscillation?

Q.2 a) Draw the output of the clipper circuit shown in Fig. 2a, If a sine wave of 15sinωt is applied as an input. Assume practical diode with suitable cut in voltage. **[10]**

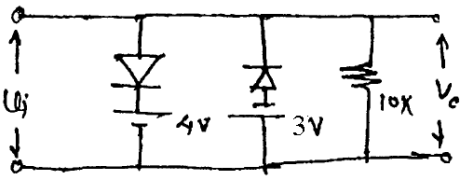

Fig. 2a

b) Derive the expression for frequency of oscillation for a Wein Bridge oscillator **[10]**

Q.3 a) Find I_{DQ} , V_{GSQ}, V_D and V_S for the circuit shown in Fig 3a **[10]**

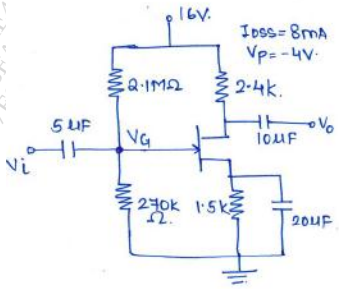

Fig. 3a

TURN OVER

b) Explain the construction and characteristics of n channel Enhancement MOSFET. Draw transfer and drain characteristics. **[10]**

Q.4 a) Derive expressions for voltage gain, input resistance and output resistance for source follower circuit using n channel MOSFET **[10]**

Fig.4a

b) Determine the hybrid pi parameters for the circuit shown in Fig 4b. The transistor parameters are $V_{BE\,(on)} = 0.7$ V, $\beta = 100$ and $V_A = 100$V. **[10]**

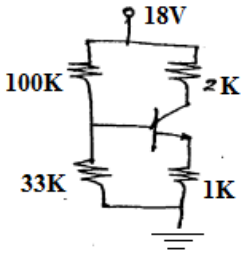

Fig. 4b

Q.5 a) For the circuit shown below in Fig.5b, the transistor parameters are $V_{BE\,(on)} = 0.7$ V, $\beta = 140$ and $V_A = \infty$. Determine Z_i, Z_o and A_V **[10]**

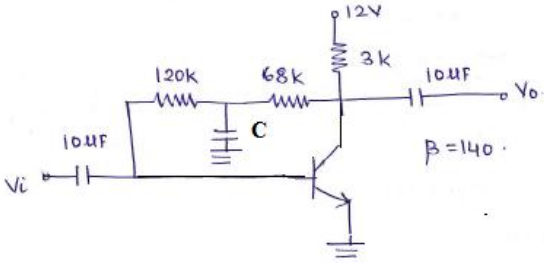

Fig. 5a

b) Draw and explain energy band diagram of MOS capacitor in accumulation, depletion and inversion region. **[10]**

Q.6 Short notes on: (Attempt **any four**) **[20]**

a) Construction and operation of schottky diode
b) LC oscillators
c) AC and DC load line
d) Small signal equivalent circuit of CC amplifier
e) Regions of operation of FET

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 06
$\bar{F} = (x + 2y + az)\, i + (bx - 3y - z)\, j + (4x + cy + 2z)\, k$
is solenoidal and determine the constants a, b, c if $\bar{F}$ is irrotational.

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 06
$\frac{s^2+2s+3}{(s^2+2s+5)(s^2+2s+2)}$.

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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Time : 3 Hours **Max Marks: 80**

1. Question No. 1 is compulsory.
2. Out of remaining questions, attempt any three questions.
3. Assume suitable additional data if required.
4. Figures in brackets on the right hand side indicate full marks.

1. (A) Compare PAL and PLA. (05)
   (B) Define the following terms of Logic Families: (05)
   (i) Power Dissipation
   (ii) Figure of Merit
   (C) Prove the following using Boolean Algebra (05)
   $$AB + \bar{A}C = (A + C)(\bar{A} + B)$$
   (D) Compare Synchronous counter with Asynchronous counter. (05)

2. (A) Design synchronous counter using T-type flip flops for getting the following sequence: $1 \rightarrow 3 \rightarrow 5 \rightarrow 7 \rightarrow 1$ (10)
   Take care of lockout condition.
   (B) Perform $(28)_{10} - (52)_{10}$ operation using 2's compliment method. (05)
   (C) Write $(32)_8$ into its Binary code, BCD code, and Hexadecimal code. (05)

3. (A) Implement the following Boolean equation using single 4:1 MUX and few logic gates: (10)
   $$F(P,Q,R,S) = \Pi M(0, 2, 5, 6, 7, 9, 12, 15)$$
   (B) Compare Combinational circuits with Sequential circuits. (05)
   (C) Implement a circuit having two inputs *A* and *B* and single output *Y* such that for any inputs of *A* and *B*, the output *Y* will always be 1 (i. e. $Y = 1$) using only NAND gates. (05)

4. (A) Draw a neat circuit of BCD adder using IC 7483 and explain. (10)
   (B) Using Quine McClusky method, minimize the following: (10)
   $$F(P,Q,R,S) = \sum m(1, 2, 3, 5, 9, 12, 14, 15) + d(4, 8, 11).$$

5. (A) Write VHDL code for negative edge triggered 3 bit binary down counter with active low Preset and Clear terminal. (10)
   (B) Convert JK type flip flop into D type flip flop. (05)
   (C) Compare SRAM with DRAM. (05)

6. (A) What is shift register? Explain any one type of shift register. Give its application. (10)
   (B) Design a Mealy type sequence detector circuit to detect a sequence 1101 using T type flip flops. (10)

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Time: 3hrs Total marks : 80

Note: i Attempt four questions, question no 1 is compulsory.

ii. Assume suitable data where ever required.

iii. Answers to the questions should be grouped together.

iv. Figure to the right of question indicates full marks.

Q1. Attempt any Four: 20

a) Explain working of RTD and mention its range.

b) Draw block diagram of generalised measurement system and explain its components

c) Write note on piezoelectric transducers.

d) Significance of three and half digit display

e) Explain Alternate mode and Chop mode in Dual trace oscilloscope

Q2. a. Define Q factor and explain working of Q meter for Q factor measurement 10

b. Draw and explain Kelvin's Double bridge and it's application in very low resistance measurement 10

Q3. a) Draw neat block diagram of CRO and explain its' function and comment on role of delay line in CRO. 10

b) Explain single and multichannel data acquisition system with neat diagram 10

Q4. a)Draw and explain Maxwell bridge and its application . 10

b) Define power and energy and explain working of a single phase energy meter. 10

Q5.a) Discuss DSO with the help of block diagram along with various modes of operation also explain its applications. 10

b) What are various A/D converting Techniques ? Explain any one in detail. 10

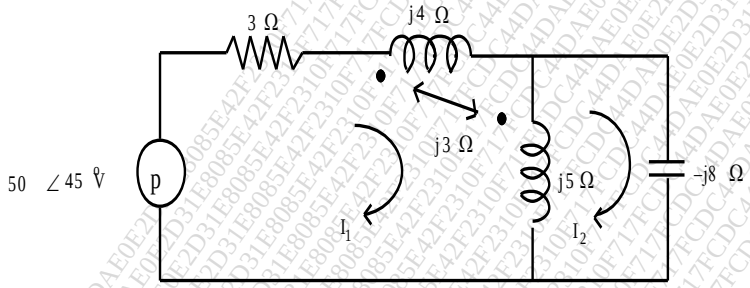
Q6. a) Explain Block diagram and application of wave analyzer 10

b) Draw and explain working of Capacitive transducer for level measurement. 10

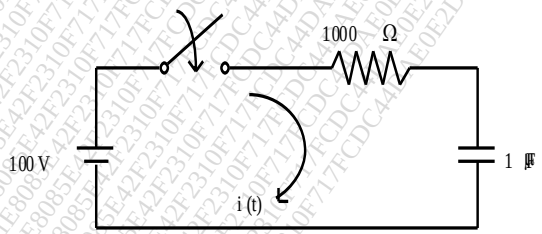
Time: 3 hours Total Marks: 80

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**



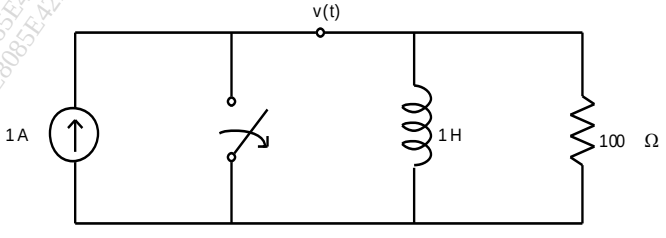
(B) In the network of Fig. switch is closed at t = 0. With capacitor uncharged, find value for i and $\frac{di}{dt}$ at $t = 0^+$. **05**



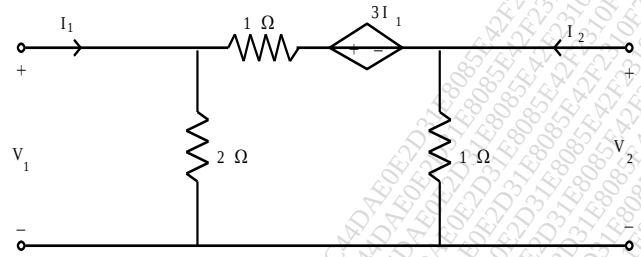
(C) Prove that AD – BC = 1 for Transmission parameters. **05**

(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**

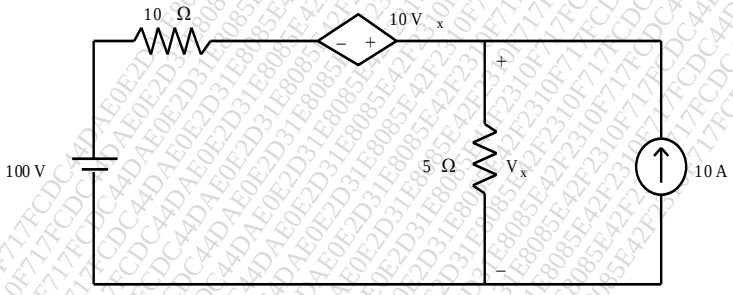
2 (A) In the network shown in Fig., at t = 0, switch is opened. Calculate v, $\frac{dv}{dt}$, $\frac{d2v}{dt2}$ at t = 0+. **10**



(B) For the network shown in Fig., find Y and Z-parameters. **10**



3 (A) Determine the current through 10 Ω resistor in the network of Fig. **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**

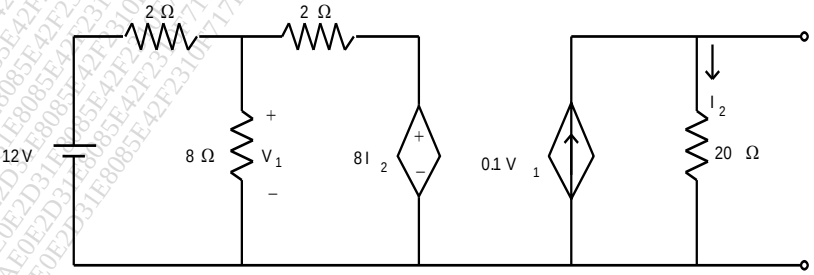
i) Characteristic Impedance
ii) Propagation Constant
iii) Attenuation Constant
iv) Phase Constant at 1 kHz

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

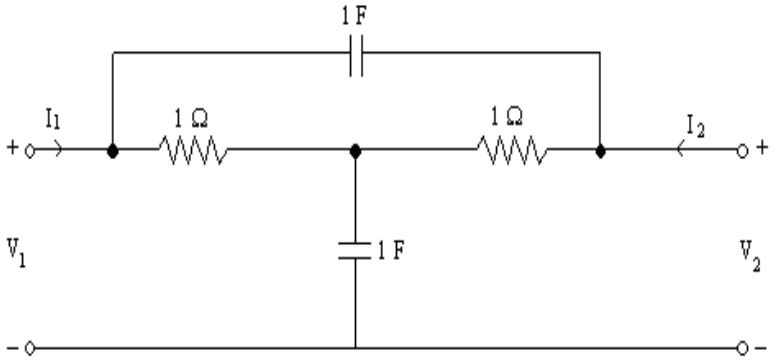
i) $\frac{s^2 + 2s + 4}{(s + 1)(s + 3)}$

ii) $\frac{s^2 + 25s + 25}{s + 4}$

(B) Find Norton's equivalent network. **10**



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

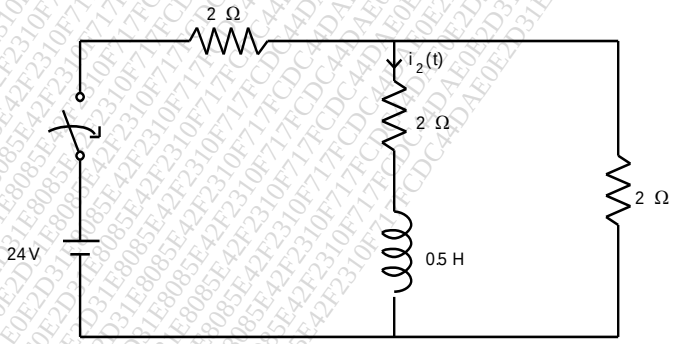


(B) Realize the following functions in Foster II and Cauer I form **10**

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

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) Determine current i2 (t) in the network of Fig., when switch is closed at t = 0. The inductor is initially deenergized. **10**



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