(**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 $\cos t \cos 2t \cos 3t$.   05

       b)   Construct an analytic function whose real part is $e^x \cos y$.   05

       c)   Find the directional derivative of $\emptyset = x^4 + y^4 + z^4$ at point   05
             $A\,(1, -2, 1)$ in the direction of AB where B is $(2, 6, -1)$.

       d)   Expand $f(x) = lx - x^2,\ 0 < x < l$ in a half-range sine-series.   05

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

       b)   Find the Fourier series for   06
             $$f(x) = \begin{cases} -c & -a < x < 0 \\ c, & 0 < x < a \end{cases}$$

       c)   Find the inverse Laplace transform of   08

       (i) $$\frac{4s + 12}{s^2 + 8s + 12}$$

       (ii) $$\log\left(\frac{s^2 + a^2}{\sqrt{s + b}}\right)$$

Q. 3   a)   State true or false with proper justification "There does not exists an   06
             analytic function whose real part is $x^3 - 3x^2y - y^3$.

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

       c)   Expand $f(x) = 4 - x^2$ in the interval $(0, 2)$.   08

Q. 4   a)   Use Gauss's Divergence theorem to evaluate $\iint_S \bar{N} \cdot \bar{F}\ dS$ where   06
             $\bar{F} = 4x\,i + 3y\,j - 2z\,k$ and S is the surface bounded by
             $x = 0, y = 0, z = 0$ and $2x + 2y + z = 4$.

TURN OVER

1

b) Prove that
$$\int x^3 \cdot J_0(x)\, dx = x^3 \cdot J_1(x) - 2x^2 \cdot J_2(x).$$
06

c) Solve using Laplace transform $\dfrac{dy}{dt} + 3y = 2 + e^{-t}$ with $y(0) = 1$.
08

Q. 5 a) Find Laplace transform of $(1 + 2t - 3t^2 + 4t^3)H(t - 2)$ where
$$H(t - 2) = \begin{cases} 0, & t < 2 \\ 1, & t \geq 2 \end{cases}$$
06

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

c) Obtain complex form of Fourier Series for $f(x) = e^{ax}$ in $(-\pi,\ \pi)$ where a is not an integer. Hence deduce that when α is a constant other than an integer
08

$$\sin \alpha x = \frac{\sin \pi \alpha}{i\pi} \sum \frac{(-1)^n n}{(\alpha^2 - n^2)} e^{inx}$$

Q. 6 a) Using Green's theorem evaluate
$$\oint_C \left(e^{x^2} - xy\right) dx - \left(y^2 - ax\right) dy$$
where C is the circle $x^2 + y^2 = a^2$.
06

b) Express the function
$$f(x) = \begin{cases} 1 & for\ |x| < 1 \\ 0 & for\ |x| > 1 \end{cases}$$
as a Fourier Integral.
06

c) Under the transformation $w = (1 + i)z + (2 - i)$, find the region in the w −plane into which the rectangular region bounded by $x = 0, y = 0, x = 1, y = 2$ in the z −plane is mapped.
08

_____xxx_____xxx_____

(3 Hours)   **[Total Marks: 80]**
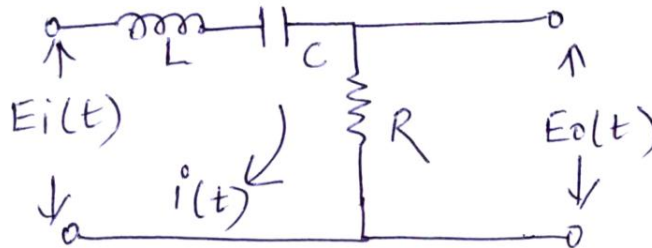
N. B. : (1) Question **No. 1** is **compulsory**.
  (2) Attempt any **three** questions from **remaining** questions.
  (3) Assume suitable **data** if **necessary**.

Q.1 (a) List name of bridges for RLC measurement with proper classification.   04
.

Q.1 (b) Find transfer function of given network.   04
.

Q.1 (c) What is cold junction compensation in thermocouples?   04
.

Q.1 (d) Draw a block diagram of generalized data acquisition system and explain its   04
.   components.

Q.1 (e) Check whether given system is stable   04
. $$s6 + 3s5 + 2s4 + 9s3 + 5s2 + 12s + 20 = 0$$

Q.2 (a) Explain Kelvin's double bridge and its application in low resistance measurement.   05

                                    05

   (b) Obtain C[s] / R[s] using block diagram reduction technique   10
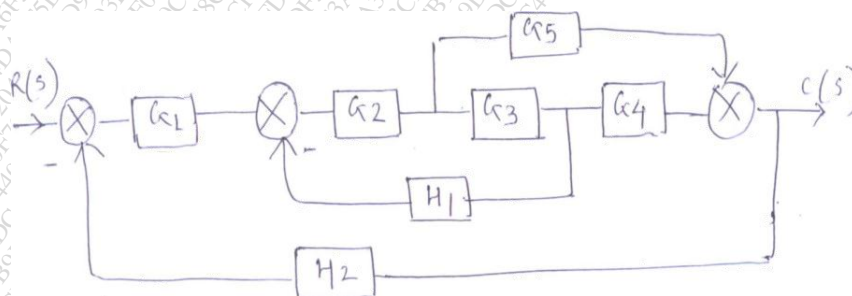
Q.3 (a) For unity gain system having   10

$$G(s) = \frac{K}{S(S+5)(S+3)}$$

Sketch root locus and comment on stability.

   (b) Draw Bode plot for following transfer function is   10

$$G(s)H(s) = \frac{800}{s^2(s+10)(s+40)}$$

And predict stability.

Q.4 (a)   What is multiplexing ?compare FDM with TDM   05

     (b)   The system has   05
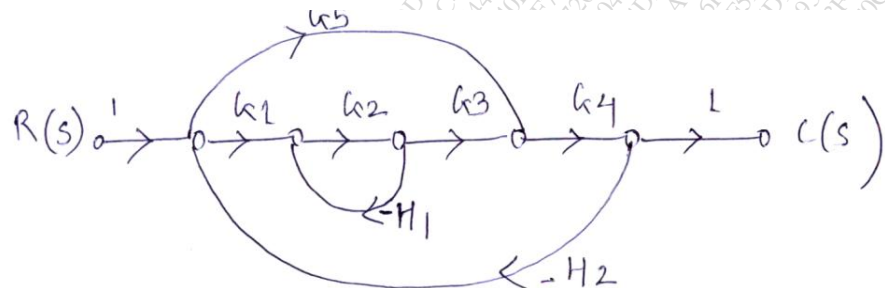
$$G(S)H(S) = \frac{K}{S(S+2)(S+4)(S+8)}$$

Using Routh criterion find range of K for stability.

     (c)   Explain working of strain gauge and its application in load measurement.   10

Q.5 (a)   Find C(s)/R(s) using Mason's gain formula   10

     (b)   Draw and discuss Hay bridge and its application in measurement of inductance.   10

Q.6 (a)   Explain landline telemetry and discuss about any one landline telemetry system.   05

     (b)   For a system with transfer function $\dfrac{64}{s2+5s+64}$ with unit step input   05

Find damping ratio, damped frequency of oscillations and time for peak overshoot.

     (c)   Compare temperature transducers Thermistors and thermocouples on the basis of   05
            principle, characteristics, ranges and applications.

     (d)   Explain how the stability of system is analyzed using Nyquist criteria.   05

_____

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

N.B.: 1) Question No. 1 is Compulsory.

2) Answer any **THREE** questions from **Q.2 to Q.6**.

3) Figures to the right indicate full marks.

Q 1. a) Evaluate the Laplace transform of $\sqrt{1+\sin t}$ [5]

b) Find directional derivative of $\phi = 4xz^2 + x^2yz$, at $(1,-2,-1)$ in direction of $2i - j - 2k$ [5]

c) Find orthogonal trajectories of the family of curves $e^x \cos y - xy = c$.[5]

d) Obtain half range sine series for $f(x)=x, \quad 0<x<2$.   [5]

Q 2. a) If $u + v = e^{2x}(x\cos 2y - y\sin 2y)$ then find analytic function $f(z)$ by Milne Thomson Method [6]

b) Find the Fourier series for $f(x) = 9 - x^2$, $-3 \le x \le 3$ [6]

c) Find the Laplace transform of the following

i) $L[t\sqrt{1+\sin t}]$ ii) $L\left[\dfrac{\sinh 2t}{t}\right]$ [8]

Q 3. a) Using Convolution theorem, find Inverse Laplace of $\dfrac{s}{(s^2+4)^2}$.   [6]

b) Prove that $J_{-5/2}(x) = \sqrt{\dfrac{2}{\pi x}}\left[\dfrac{3}{x}\sin x + \dfrac{(3-x^2)}{x^2}\cos x\right]$.   [6]

c) Find Fourier series for $f(x) = (\pi - x)^2$ in $0 \le x \le 2\pi$. Hence deduce that

$$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots$$ [8]

Q 4 a) Find the Fourier transform of $f(t) = e^{-|t|}$ [6]

b) Show that the function $f_1(x) = 1$, $f_2(x) = x$ are orthogonal on $(-1,1)$ and determine the

constant A & B so that functions $f_3(x) = 1 + Ax + Bx^2$ is orthogonal to both $f_1(x)$ and

$f_2(x)$ on that interval.   [6]

c) Find bilinear transformation which maps the points z=1, i,-1 onto the points   w=i, 0,-i hence

Page **1** of **2**

find the image of $|z| < 1$ on to w plane find invariant points of this transformation [8]

Q 5 a) Solve using Laplace Transform $\dfrac{d^2 y}{dt^2} + 2\dfrac{dy}{dt} + y = t\,e^{-t}$ given $y(0) = 4$ and $y'(0) = 2$. [6]

b) Find Complex form of the Fourier series for $f(x) = e^{ax}$ in $-\pi < x < \pi$ where 'a' is a

real constant. Hence deduce that $\dfrac{\pi}{a \sinh a\pi} = \displaystyle\sum_{n=-\infty}^{\infty} \dfrac{(-1)^n}{n^2 + a^2}$ [6]

c) Verify Green's Theorem in the plane for $\displaystyle\oint_C (3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$ where C is

the boundary of the region defined by $y = x^2$ and $y = \sqrt{x}$. [8]

Q 6. a) Prove that $J_n^{''}(x) = J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)$ [6]

b) Find the map of the line x−y=1 by transformation $w = \dfrac{1}{z}$ [6]

c) Evaluate $\displaystyle\iint_S \overline{F}.d\overline{s}$ where $\overline{F} = 4x\hat{i} - 2y^2\,\hat{j} + z^2\,\hat{k}$ where S is the region bounded by

$x^2 + y^2 = 4$, $z = 0$, $z = 3$ using Gauss divergence theorem. [8]

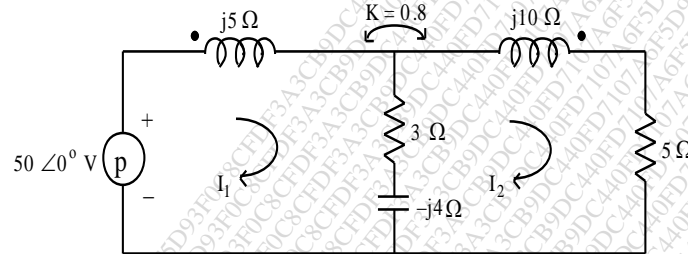*****************

Time: 3 hours   Total Marks: 80
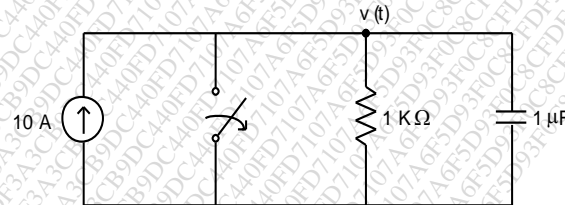
N.B.
1) Question No. 1 is Compulsory
2) Out of remaining questions, attempt any three
3) Assume suitable data if required
4) Figures to the right indicate full marks

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

(B) In the given network of Fig., switch is opened at t = 0. Solve for v and $\frac{dv}{dt}$ at t = 0+.   05


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

(D) Define the folowing parameter of transmission lines: 05
        i)   Input impedance
        ii) Charateritics Impedance
        iii) VSWR
        iv) Reflection Coefficient
        v)   Transmission Coefficient

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

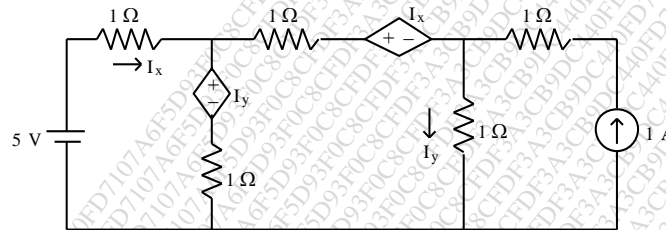Page **1** of **3**
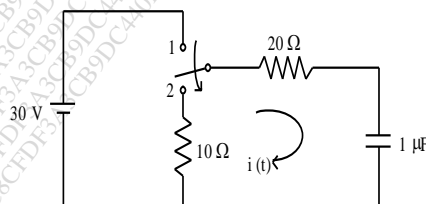
(B) For the network shown in Fig., find Z and Y-parameters.   10
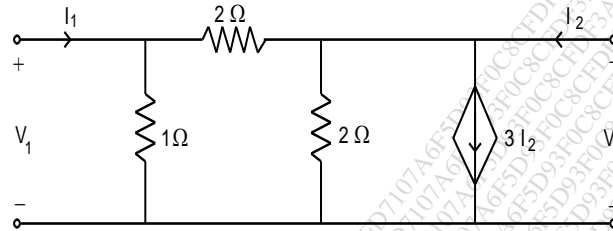
3 (A) Find currents in the three meshes of network shown in Fig.   10

(B) The parameters of a transmission lines are R = 65Ω/km, L=1.6mH/km, G = 2.25 mmho/km,   10
C=0.1µF/km. Find
     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) $\dfrac{s^4 + 3s^3 + s^2 + s + 2}{s^3 + s^2 + s + 1}$

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

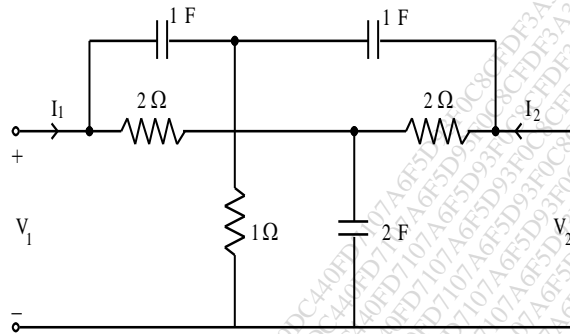(B) Obtain Thevenin equivalent network of Fig.   10
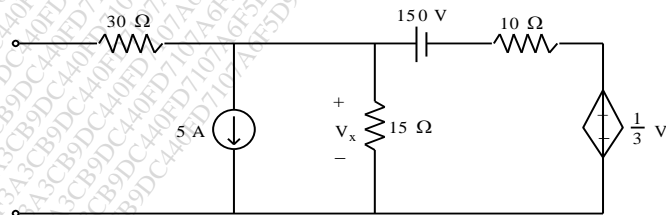
5 (A) Find Y-parameters for the network shown in Fig.   10

(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 $Z_L = 25 +$ 10
    j50 ohm. Use smith chart and Find VSWR and Reflection coefficient at the load.

(B) In the network of Fig. switch is in position 'a' for a long time. At t = 0 switch is moved from a to   10
    b. Find $v_2(t)$. Assume that the initial current in 2 H inductor is zero.

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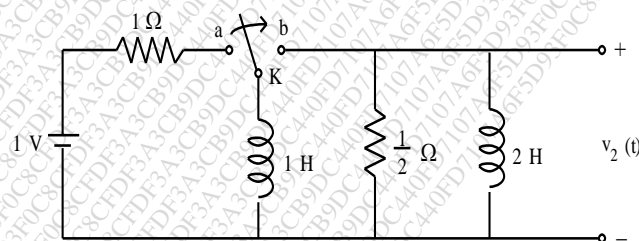
Max. Marks:80   **Duration:** 3hrs

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   Give the equation for the current in semiconductor diode. With the help of this equation   5
     explain in detail the V-I characteristics of a semiconductor diode.

b   Explain effect of temperature on JFET and derive equation for zero temperature drift.   5

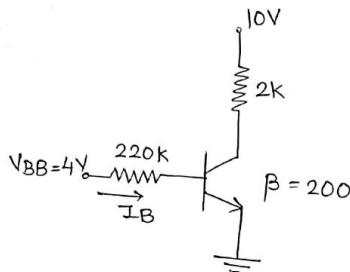c   For the circuit shown in fig 1 determine small signal hybrid pi parameters of transistor.   5

Fig.1

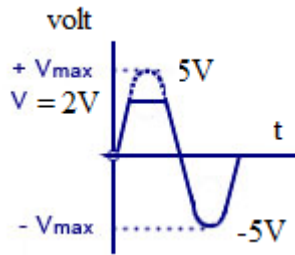d   Design clipper circuit for the output shown in figure.2 Assume diode is ideal.
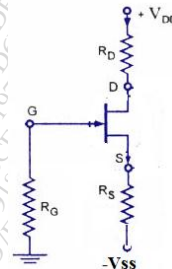

Fig.2   Fig.3

e   For the FET shown in figure.3 the drain current equation is $I_{DQ} = 9\left(1 + \frac{V_{GSQ}}{3}\right)^2$ mA.   5
     Determine I_{DQ}, V_{GSQ}, V_{DSQ}, V_D. V_{DD}=18V, R_D=2.2kΩ, R_S=1.2KΩ, $-V_{SS}$=-9V and
     R_G=1MΩ.

Q.2

a   For the circuit shown in Fig.4 determine the V_{ECQ}, I_{CQ}, V_C, and V_E.   10

$+V_{CC} = 20V$

R_C 2.7 $k\Omega$

8.2 $k\Omega$ R_1

$\beta = 120$
$V_{BE} = 0.7V$

2.2 $k\Omega$ R_2 R_E 1.8 $k\Omega$

$-V_{EE} = -20V$

Fig.4

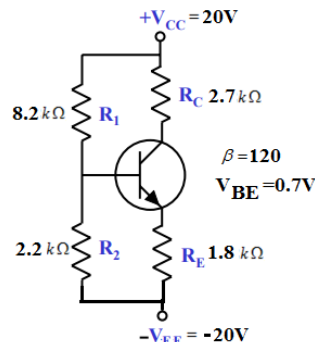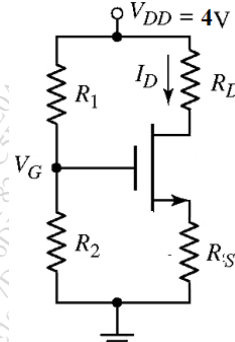$V_{DD} = 4V$

R_1 I_D R_D

V_G

R_2 R_S

Fig.5

b   Design the circuit shown in Fig.5 such that $V_{GS}=0.50V$ and $V_{DS}=2.5V$. The transistor   10
parameters are: $V_{TN}=0.24V$, Kn=1.1mA/V2, and $\lambda=0$. Let $R_1+R_2=50K\Omega$.

Q.3

a   Analyze and derive the expression for the voltage gain, input impedance and output   10
impedance for common collector amplifier with voltage divider biasing.

b   For the amplifier shown in Fig.6 analyze and determine.   10
   i.   Small-signal voltage gain.
   ii.   Input and output impedance.
   BJT and circuit parameters are: $\beta = 100, V_{BE} = 0.7V$. $R_1 = 56k\Omega$, $R_2 = 12.2k\Omega$,
   $R_E = 0.4k\Omega$, $R_C = 2k\Omega$, $R_L = 10k\Omega$ $R_S = 0.5k\Omega$, $V_{CC} = 10V$
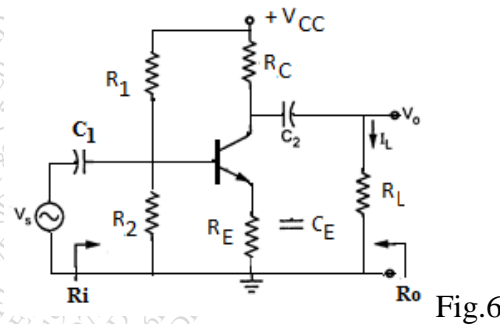

$+V_{CC}$

R_1 R_C

C_1 C_2 V_o

v_s R_2 R_E C_E R_L

Ri   Ro   Fig.6

Q.4

  a Draw the structure of an N-channel Enhancement type MOSFET. Explain its working 10
with the help of output drain characteristics and transfer characteristics.

  b For the MOSFET common source amplifier shown in fig.7 determine output voltage, 10
input impedance and output impedance. Given: $V_{TN} = 1V$, $K_N = 0.5$ mA/V^2, $\lambda=0.01V^{-1}$.
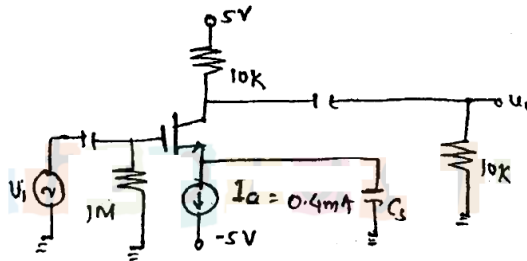

Fig.7

Q.5

  a Draw and explain energy band diagram of MOS capacitor in accumulation, depletion 10
and inversion region.

  b Derive the expression for frequency of oscillation for a transistorized (BJT) RC phase 10
shift oscillator.

Q.6   Write a short note on following.

  a Cristal oscillator and its application.   5

  b Schottkey Diode (Construction and operation and application)   5

  c Graphical analysis of BJT amplifier to determine parameters.   5

  d h-Parameter equivalent circuit for BJT   5

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N.B : 1. Question No. 1 is compulsory.
            2. Attempt any three from the remaining questions.

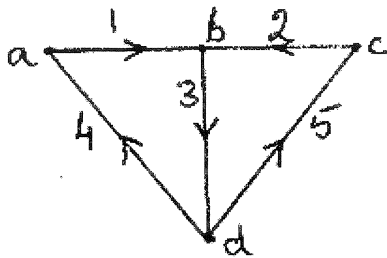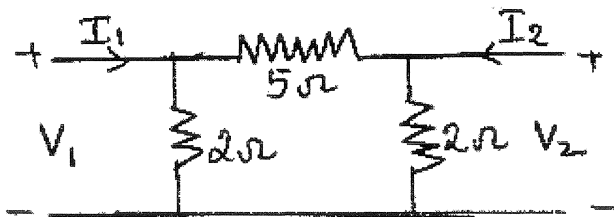1. (a) Find the voltage drop across 5Ω resistor in the circuit given below.   5
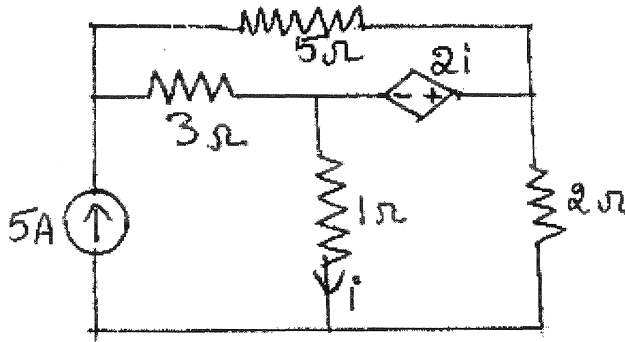
   (b) For the graph given below obtain the incidence matrix and find the number of   5
        possible trees.

   (c) Find y parameters for the two-port network shown in figure.   5

   (d) Check whether the following polynomials are Hurwitz   5
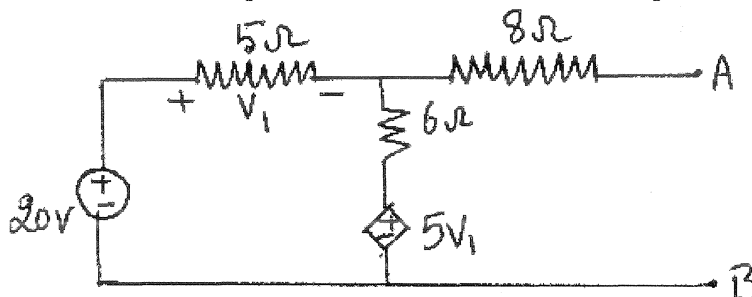   (i) $P(s) = S^4 + 7S^3 + 6S^2 + 21S + 8$
        (ii) $P(s) = S^5 + 2S^3 + S$

2. (a) Find the Thevenin's equivalent across AB and find the power dissipated in a 25Ω load. 10

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(b) Find h parameters for the following Two-port network.   5
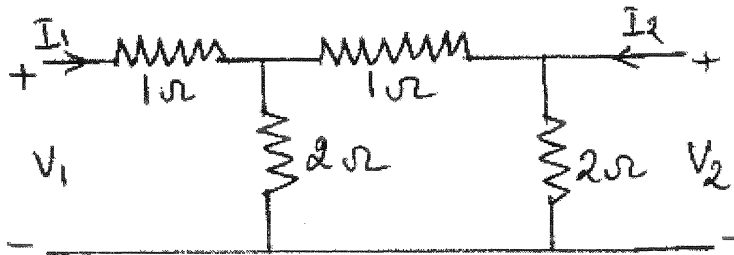
(c) In the network shown below the switch is closed at t = 0. Assuming all initial   5
conditions to be zero, find i, di/dt, d^2i/dt^2 for t = 0^+ .
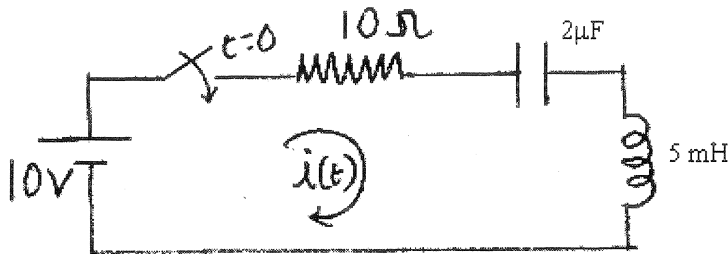
3. (a) Find the tie-set and f-cutset matrix for the oriented graph shown below.   10
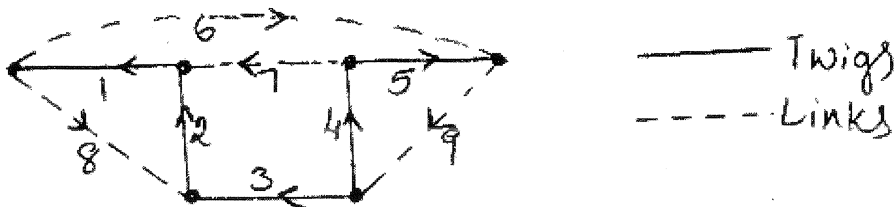
(b) Realize the following function in Foster I and Foster – II forms.   10

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

4. (a) A switch is in position A for a long time and then thrown to position B at t = 0.
Find i(t) for > 0. At what value of 't' the current i(t) will become half of current at
t =0   10
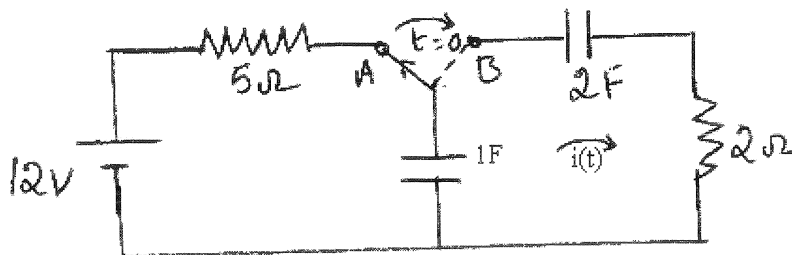
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(b) For the following network find the driving point impedance function.   5
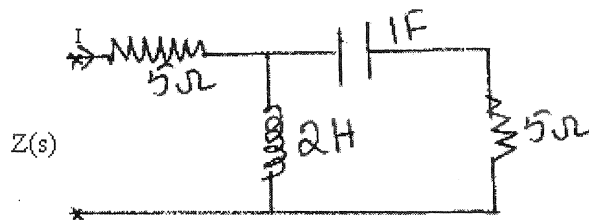
(c) Find the condition for symmetry and reciprocity for a two port network using any   5
one parameter.

5. (a) Obtain the ABCD parameters of the following network. If two such networks are   10
cascaded find the overall ABCD parameter.
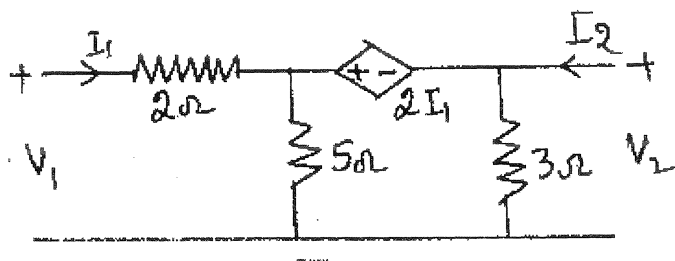
(b) Check whether the following function if positive real or not.   5

$$F(s) = \frac{\left(S^2 + 6S + 5\right)}{\left(S^2 + 9S + 14\right)}$$

(c) Find the oriented graph if the incidence matrix of the network is as given below.   5

$$A = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & -1 & 1 & 0 & -1 & 0 & 0 \\ -1 & 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & -1 & 0 & 1 & 0 \end{bmatrix}$$

6. (a) Find the mesh currents if the coupling factor k = 0·6   10
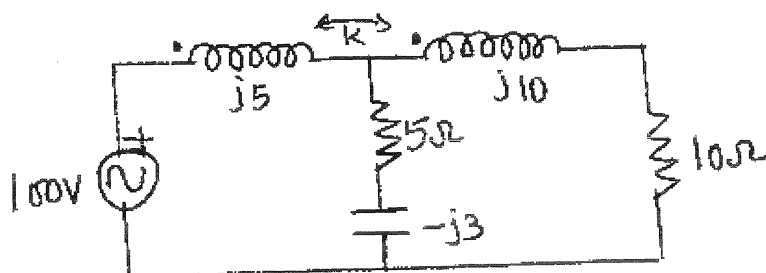
[TURN OVER

(b) Find $i_2(t)$ using Laplace transform.   **10**

Time: 3 Hours   **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) Prove that for a JFET the gate-source bias for zero temperature drift of drain current is at $|V_P| - 0.63$ volts.

    b) Explain the hybrid pi model of BJT.

    c) Explain Zener as voltage regulator.

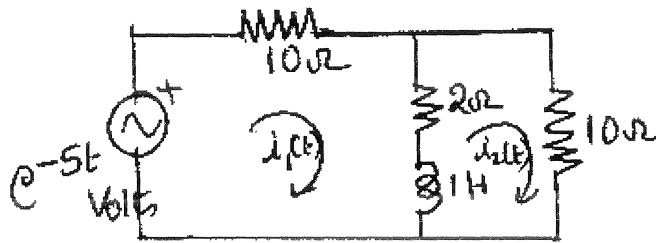   d) Consider a BJT has parameters $f_T = 500$MHz at $I_C = 1$mA, $\beta = 100$ and $C\mu = 0.3$pF. Calculate bandwidth of f_β and capacitance $C\pi$ of a BJT.

    e) Draw and explain small signal model of a diode.

    f) Why should R_C be as large as possible in the design of CE amplifier?

Q.2 a) Design a voltage divider bias network using a supply of 24 V, a transistor   **[10]** with $\beta = 110$ and an operating point of $I_{CQ} = 4$ mA and $V_{CEQ} = 8$V. Assume $V_E = \dfrac{1}{8}V_{CC}$.

    b) Explain the fabrication steps of passive elements.   **[5]**

    c) What are the important JFET parameters and define it from characteristics.   **[5]**

Q.3 a) Design the resistors of a single stage CS amplifier for audio frequency with   **[10]** BFW11 with $I_{DS} = (3.3 \pm 0.6)$ mA and $|A_V| = 12$.

    b) Draw CS JFET amplifier with self bias circuit and derive the expression   **[10]** for voltage gain input impedance and output impedance.

Q.4 a) Draw small signal hybrid parameter equivalent circuit for CE amplifier and   **[10]** define the same. What are the advantages of h parameters?

    b) For the circuit shown below in Fig.4b, the transistor parameters are V_{BE} **[10]** $_{(on)} = 0.7$ V, $\beta = 200$ and $V_A = \infty$.

    i) Derive the expression for lower cut-off frequency (or time constant) due to input coupling capacitor.

    ii) Determine lower cut-off frequency and midband voltage gain.
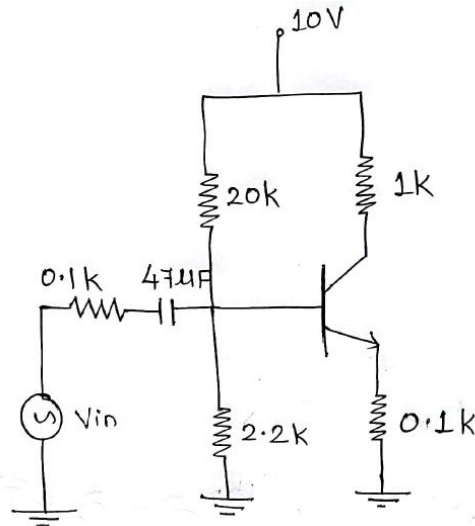
Fig.4b

Q.5 a) Design an L section LC filter with full wave rectifier to meet the following **[10]** specifications: The DC output voltage $v_{DC} = 220$ V, deliver $I_L = (70 \pm 20)$ mA to the resistive load and the required ripple factor is 0.04.

b) For the circuit shown below in Fig.5b, the transistor parameters are V_{BE} **[10]** $_{(on)} = 0.7$ V, $\beta = 100$ and $V_A = \infty$. Determine Z_i, Z_o and A_V

Fig. 5b

Q.6 Short notes on: (Attempt any four) **[20]**
a) BJT high frequency equivalent circuit
b) Types of resistors and capacitors
c) Stability factors of various biasing techniques of BJT
d) Different types of filters
e) Comparison of BJT CE and JFET CS amplifier

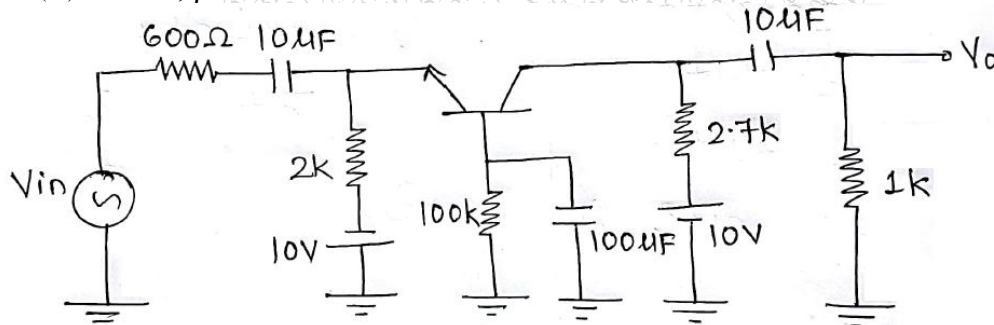| Transistor type	Ptmax @25°C Watts	Itmax @25°C Amps	VCE(sat) volts d.c.	VCE volts d.c.	VCBO (Sus) volts d.c.	VCEO (Sus) volts d.c.	VCEO volts d.c.	Vbeo volts d.c.	Tj max °C	D.C. current gain min	typ.	max.	Small Signal min.	typ.	max.	VBE max.	θja °C/W	Derate above 25°C W/°C
2N 3055	115.5	15.0	1.1	100	60	70	90	7	200	20	50	70	15	50	120	1.8	1.5	0.7
ECN 055	50.0	5.0	1.0	60	50	55	60	5	200	25	50	100	25	75	125	1.5	3.5	0.4
ECN 149	30.0	4.0	1.0	50	40	—	—	8	150	30	50	110	33	60	115	1.2	4.0	0.3
ECN 100	5.0	0.7	0.6	70	60	65	—	6	200	50	90	280	50	90	280	0.9	3.5	0.03
BC147A	0.25	0.1	0.25	50	45	50	—	6	125	115	180	220	125	220	260	0.9	—	—
2N 525(PNP)	0.225	0.5	0.25	25	30	—	—	—	100	35	—	65	—	45	—	—	—	—
BC147B	0.25	0.1	0.25	30	45	50	—	6	125	200	290	450	240	330	500	0.9	—	—

Transistor type	hie	hoe	hre	θja
RC 147A	2.7 KΩ	18µ℧	1.5 × 10⁻⁴	0.4°C/mw
2N 525 (PNP)	1.4 KΩ	25µ℧	3.2 × 10⁻⁴	0.4°C/mw
RC 147B	4.5 KΩ	30µ℧	2 × 10⁻⁴	—
ECN 100	500 Ω	—	—	—
ECN 149	250 Ω	—	—	—
ECN 055	100 Ω	—	—	—
2N 3055	25 Ω	—	—	—

BFW 11—JFET MUTUAL CHARACTERISTICS

-VGS volts	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.6	2.0	2.4	2.5	3.0
IDS max. mA	10	9.0	8.3	7.5	6.8	6.1	5.4	4.2	3.1	2.2	2.0	1.1
IDS typ. mA	7.0	6.0	5.4	4.6	4.0	3.3	2.7	1.7	0.8	0.2	0.0	0.0
IDS min. mA	4.0	3.0	2.2	1.6	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0

N-Channel JFET

Type	VGS max. Volts	VDS max. Volts	VGD max. Volts	Pt max. @25°C	IDSS	Tj max.	gm (typical)	-Vp Volts	rd	Derate above 25°C	θja
1N3822	50	50	50	300 mW	2 mA	175°C	3000 µ℧	6	50 KΩ	2 mW/°C	0.50°C/mW
BFW 11 (typical)	30	30	30	300 mW	7 mA	200°C	5600 µ℧	2.5	50 KΩ	—	0.59°C/mW

(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**

Q.1 **(a)** State and prove De Morgan's Theorems   **[5]**
       (b) Compare Combinational and sequential logic Circuits   **[5]**
       (c) Define Propagation delay, Power Dissipation, Fan Out, Fan in for TTL family   **[5]**
       (d) Explain Programmable Logic Array   **[5]**

Q.2 **(a)** Prove that NAND and NOR Gates are universal Gates   **[10]**
       (b) Design a two-bit digital comparator and implement using Gates   **[10]**

Q.3 **(a)** Simplify the logical expressions using Boolean Laws and implement using Gates   **[10]**
           $Y_1 = (A + C)(A + D)(B + C)(B + D)$, $Y_2 = (AB + C)(AB + D)$
       (b) Implement the given function using 8:1 Multiplexer   **[10]**
           $F(A, B, C, D) = \sum m(0, 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 15)$

Q.4 **(a)** Explain the working of universal shift register   **[10]**
       (b) Write a VHDL program to design a 4:1 Mux   **[10]**

Q.5 **(a)** Minimize the following expression using Quine McClusky Technique   **[10]**
           $F(A,B,C,D) = \sum m(1, 3, 7, 9, 10, 11, 13, 15)$
       (b) Convert JK FF to D FF and T FF to D FF   **[10]**

Q.6 **(a)** Design a 3-bit asynchronous counter using JK FF. Draw neat timing diagram   **[10]**
       (b) Write a note on CPLDs   **[10]**

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(3 Hours)   **80 Marks**

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 a) If $F(A,B,C) = \sum m(0,3,5,7)$ with its truth table and express F in SOP and   **[20]**
POS form
b) Compare TTL and CMOS Logic families
c) Perform the following operation using 2's compliment
   i) $(7)_{10} - (15)_{10}$
   ii) $(50)_{10} - (2A)_{16}$
Comment on results of (i) and (ii)
d) Compare SRAM with DRAM

Q.2 a) Implement following Boolean function using 8:1 multiplexer   **[10]**
   $F(A,B,C,D) = \overline{A} B \overline{D} + A C D + \overline{B} C D + \overline{A} \overline{C} D$
b) Design 3 bit Binary to Gray code Converter   **[10]**

Q.3 a) What are shift registers? How are they classified? Explain working of any **[10]**
one type of shift register.
b) Write VHDL code for 3 bit up counter.   **[10]**

Q.4 a) Explain Master slave JK Flip flop   **[5]**
b). Convert T flip flop to D flip flop.   **[5]**
c) Minimize the following expression using Quine McClusky Technique   **[10]**
   $F(A,B,C,D) = \sum m(1,3,7,9,10,11,13,15)$

Q.5 a) State and prove Demorgan's theorem   **[5]**
b) b) Convert $(532.125)_8$ into decimal, binary and hexadecimal.   **[5]**
c) Explain Full Adder circuit using PLA having three inputs, 8 product terms **[10]**
and two outputs.

Q.6 a) Prove that NAND and NOR gates are universal gates   **[10]**

b) Draw and explain 3 bit asynchronous binary counter using positive edge **[10]**
triggered JK flip flop. Draw the waveforms.

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