26/12/11 SE ETRX-Sem-III (R) ENAS

277 : 2ndHf11C.mk

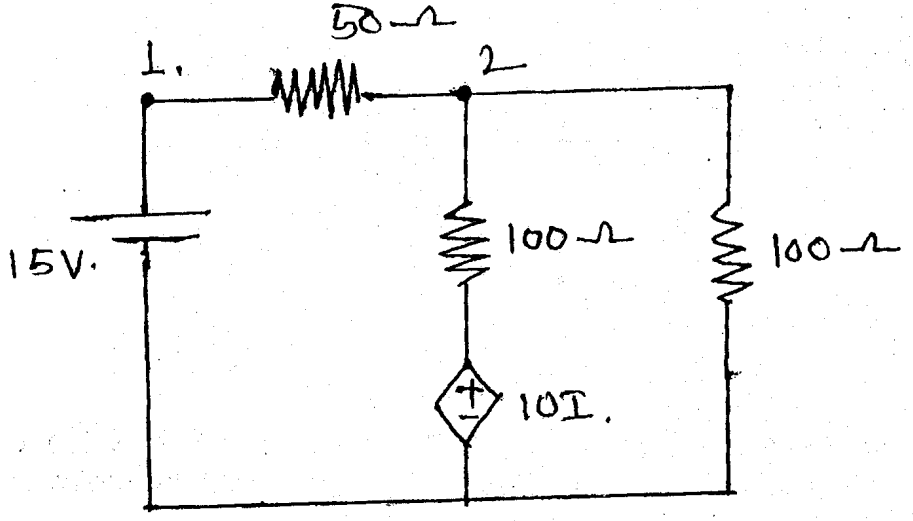
Con. 6905-11.

MP-4099

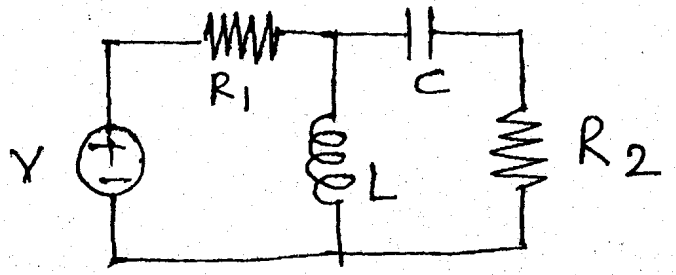
(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from the **remaining** questions.
(3) Assume **suitable data** wherever **required** but **justify** the same.
(4) **Figures** to the **right** indicate **full** marks.

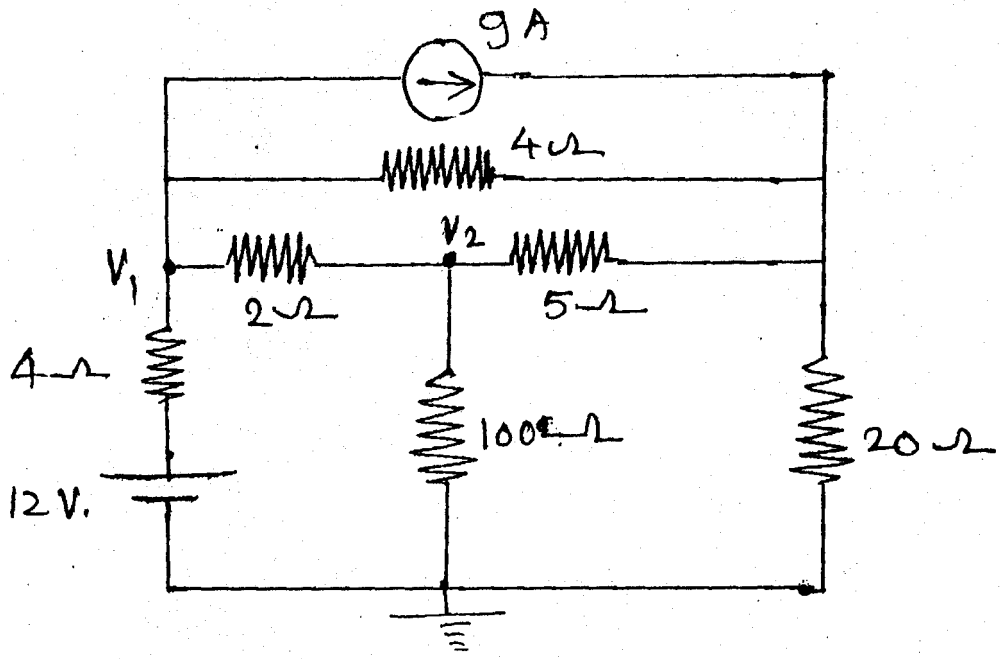
1. (a) State the properties of Hurwitz polynomial. 5
(b) Find the voltage at node 2 for the **figure** shown below :— 5



(c) State the condition for receiprocity of h-parameter and prove it. 5
(d) Draw the dual of the network shown in **figure** below :— 5

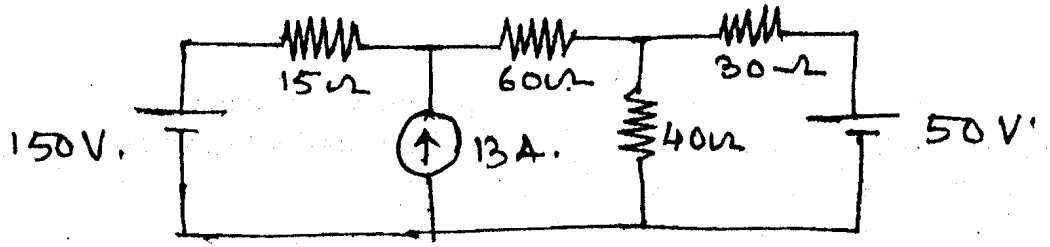


2. (a) Find the voltage across the 5 Ω resistor for the circuit shown below :— 10



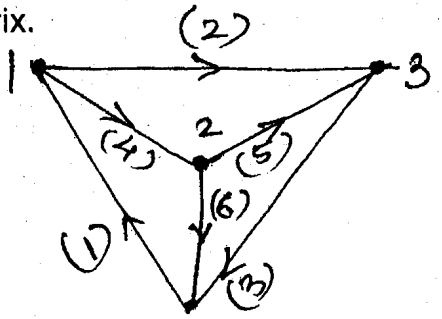
[TURN OVER

(b) Find the current through the 30 Ω resistor for the circuit shown below :— 10

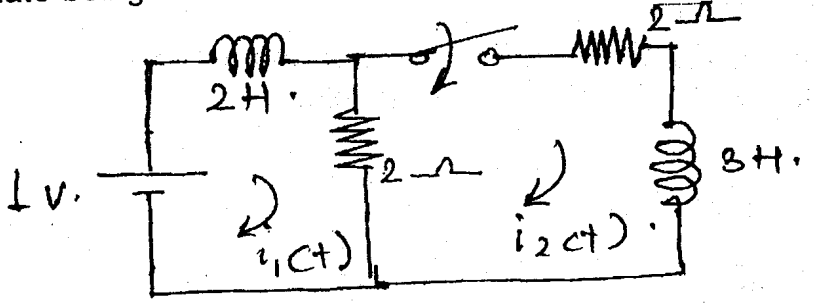


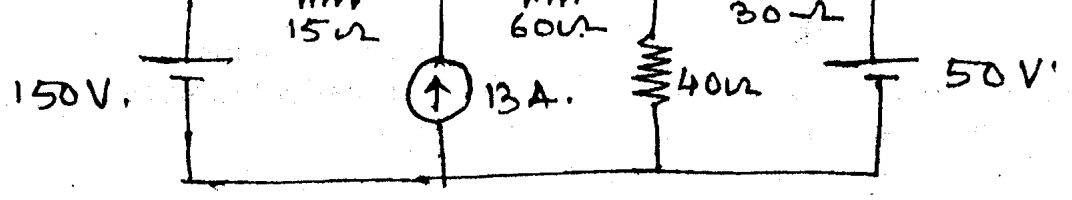
3. (a) The graph of network is shown in **figure** below, write the — 10

(i) Incidance matrix
(ii) F-cutset matrix
(iii) Tie set matrix.



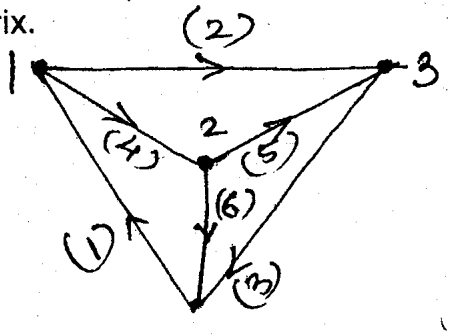
(b) In the network shown in **figure** below, the switch is closed at t = 0, the steady-state being reached before t = 0. Determine current through inductor of 3H. 10



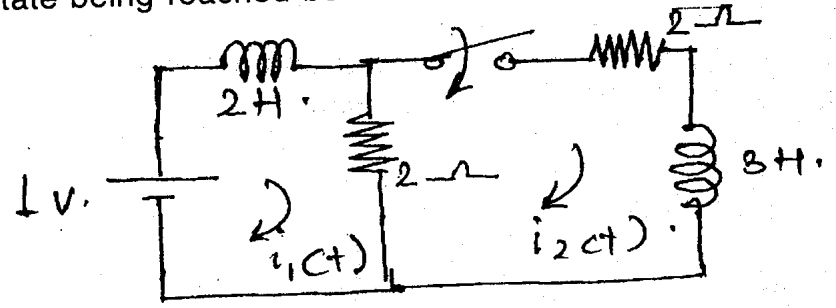


3. (a) The graph of network is shown in **figure** below, write the — 10

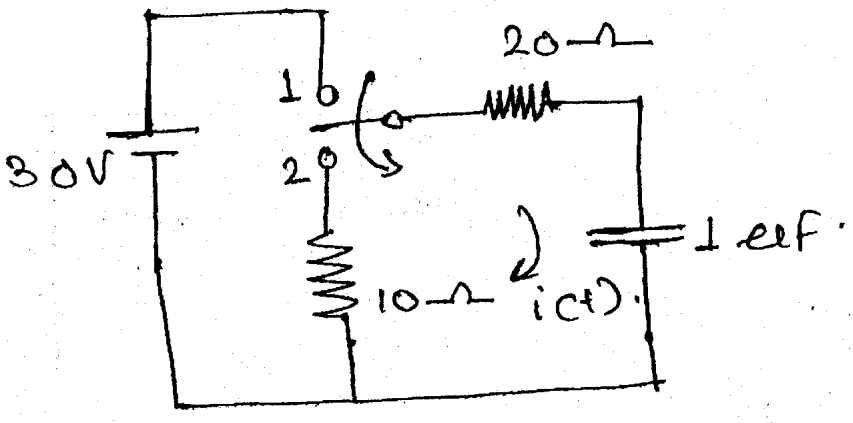
(i) Incidance matrix
(ii) F-cutset matrix
(iii) Tie set matrix.



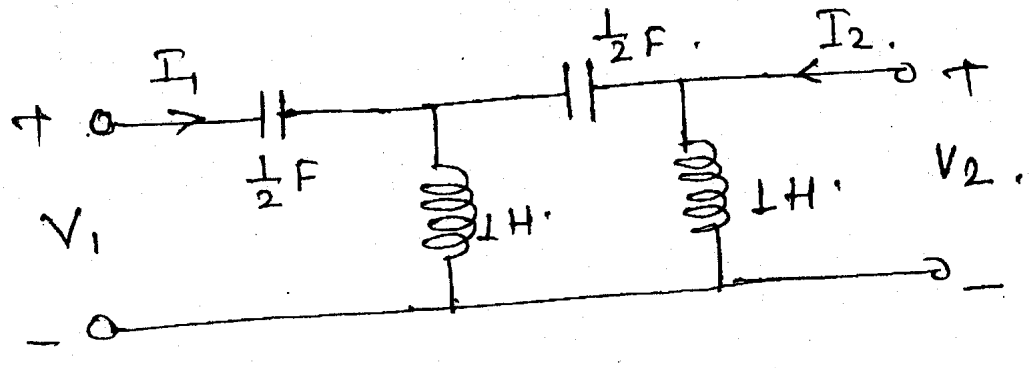
(b) In the network shown in **figure** below, the switch is closed at t = 0, the steady-state being reached before t = 0. Determine current through inductor of 3H. 10



4. (a) Find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt}$ at $t = 0^+$ for the network shown in **figure** below, when switch is changed from the position 1 to the position 2 at t = 0. Steady condition having reached before switching. 10



(b) Determine Y parameters for the network, shown in **figure** below :— 10



5. (a) Test wheather following polynomials are Hurwitz :— **10**

   (i) $P(s) = s^4 + s^3 + 5s^2 + 3s + 4$

   (ii) $P(s) = s^4 + s^3 + 2s^2 + 3s + 2$

   (b) Test wheather the following functions are positive real functions :— **10**

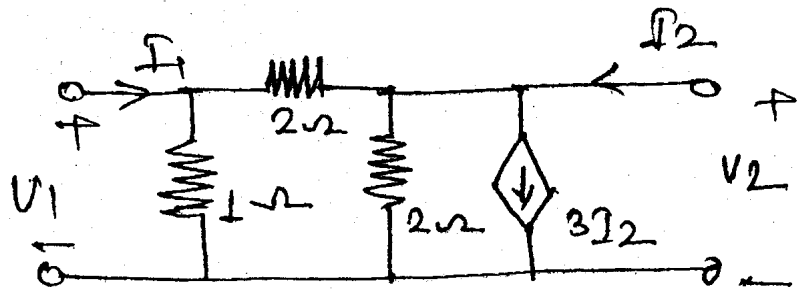
   (i) $F(s) = \dfrac{2s^3 + 2s^2 + 3s + 2}{s^2 + 1}$

   (ii) $F(s) = \dfrac{s^2 + 1}{s^3 + 4s}$.

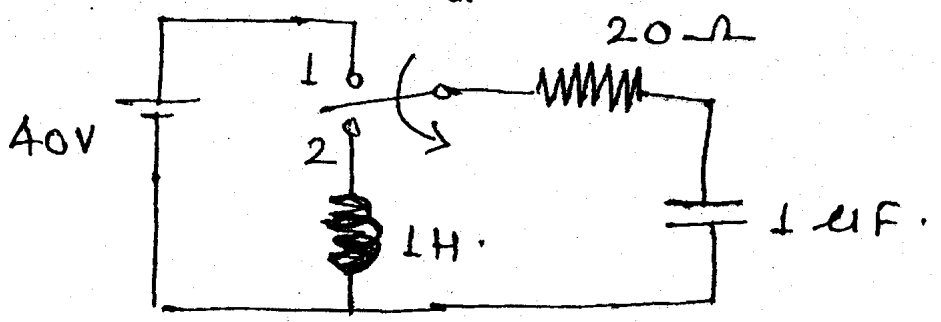
6. (a) Obtain the Cauer forms of the following RC impedance function :— **10**

$$Z(s) = \frac{(s+2)(s+6)}{2(s+1)(s+3)}.$$

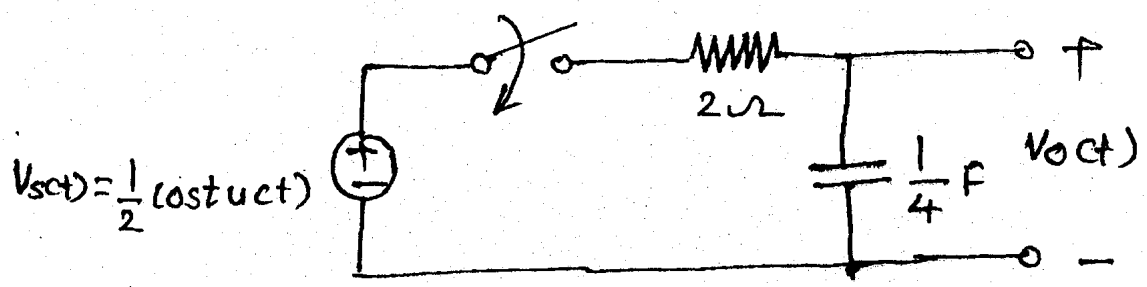
   (b) For the network shown in **figure** below find. Z and Y parameters. **10**



7. (a) In the network shown in **figure** below, the switch is changed from the position '1' to position '2' at t = 0. Steady condition having reached before switching, find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt}$ at $t = 0^+$. **10**



   (b) For the network shown in **figure** below find the response $V_0(t)$. **10**



21/12/2011 SE ETRX Sem – II (Rev)

Con. 6774-11. Control System MP–4090

(3 Hours) [Total Marks : 100

N.B. : (1) Question No.1 is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) **Figures** to **right** indicate **full** marks.
(4) Assume **suitable** data if any.

Q1. Attempt the following : (20)

(a) State the importance of mathematical modeling of the system.

(b) Define the term 'Transfer function' and state the limitations of transfer function approach.

(c) With suitable example, show how to find GM and PM from polar plot?

(d) Show the pole locations for second order system with damping ratio $\xi > 1$, $\xi = 1$, $\xi < 1$ and $\xi = 0$.

Q2.(a) Find the transfer function of the block diagram shown in **figure 1** by using Block diagram reduction method. (12)

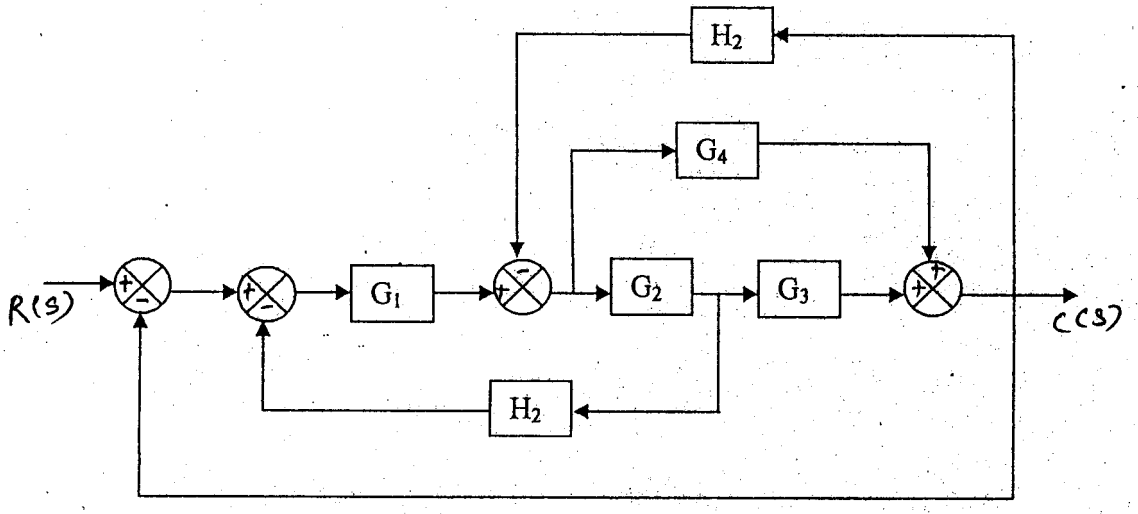


Figure 1

(b) Examine the stability by Routh's criterion of the system whose characteristic equation is $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$. (08)

Q3. (a) Derive an expression for the time response of an under damped second order system subjected to an unit impulse input. (10)

(b) The open loop transfer function of a unity feedback system is given by,

$$G(S) = \frac{K}{S(1+0.5S)(1+0.2S)}$$. Using Bode plot, find the value of K so that the Gain margin of the system become 6 dB. (10)

Q4.(a) Determine the root locus of the system with

$$G(S)H(S) = \frac{K(S+2)(S+3)}{S(S+1)}$$. (10)

(b) Differentiate open loop control system and close loop control system based on noise rejection, gain, sensitivity and stability. (04)

(c) Explain in brief permanent magnet stepper motor. (06)

Q5. (a) A unity feedback system has $G(S) = \frac{40(S+2)}{S(S+1)(S+4)}$,

Determine (i) Type of the system, (ii) Static error coefficients and (iii) Steady state error for ramp input with magnitude 4. (10)

(b) Obtain the state transition matrix for a given system matrix $A = \begin{pmatrix} 0 & 1 \\ -2 & -3 \end{pmatrix}$ (10)

Q6. (a) Explain different continuous composite controllers. (10)

(b) What is Nichol's chart? State its uses in stability study of system. (10)

Q7. Write short note on : (20)

(a) Synchro transmitters-receivers.

(b) Correlation between time domain and frequency domain

(c) Absolute and relative stability.

7/12/11 SE ETRX III (Rev.)
Basic Electronic circuits

ws Sept-2011-154

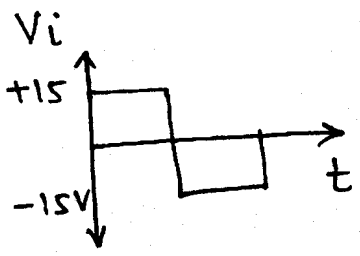
Con. 6195–11.

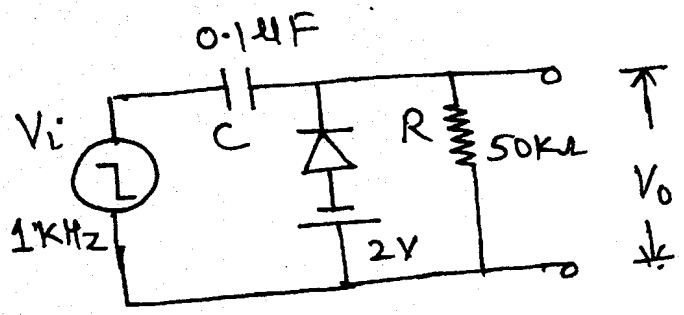
MP–4087

(3 Hours) **[Total Marks : 100**

N. B. : (1) Question No. **1** is **compulsory**.
(2) Answer any **four** questions out of remaining **six** questions.
(3) Assume any **suitable** data, wherever **required**.
(4) Answer to questions should be grouped and written **together**.

1. (a) Derive the condition for zero temperature drift biasing of FET. **5**
(b) Sketch the output waveform for the **figure** shown below : **5**





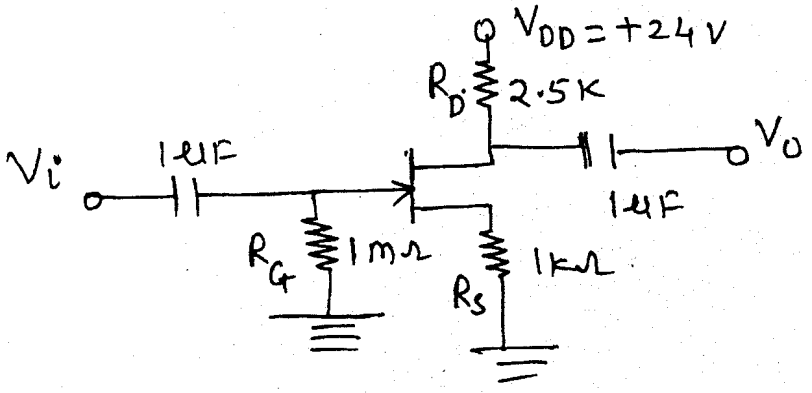
(c) Which biasing method can not be used for D-MOSFET and why ? **5**
(d) What is the maximum reverse voltage [PIV] across a diode in (i) HWR (ii) FWR with center-tapped transformer (iii) Bridge wave rectifier ? **5**

2. Design a single stage CE BJT amplifier using BC 147A to satisfy the following specifications :– **20**

$$|A_v| \geq 120,\ S_I \leq 8,\ V_{cc} = 24\,V,\ R_L = 10K\Omega\ f_L > 10H_z\ ,\ I_{CQ} = 3mA.$$

Estimate R_i and R_0 of designed amplifier. If $R_i \geq 3\ K\Omega$ is new specification then suggest suitable modification in above design. What sacrifice's you have made ? Calculate that.

3. (a) Compare L-section LC and C filter. **5**
(b) Design for full wave rectifier an L-type LC filter which gives a d.c. output voltage of 10V at a load current of 100 mA. The allowable ripple factor is 0·02. **10**
(c) Determine I_{DQ}, V_{GSQ}, V_{DSQ} for the following network :– **5**



For JFET.
$I_{DSS} = 7$ mA
$V_P = -2{\cdot}5$ V

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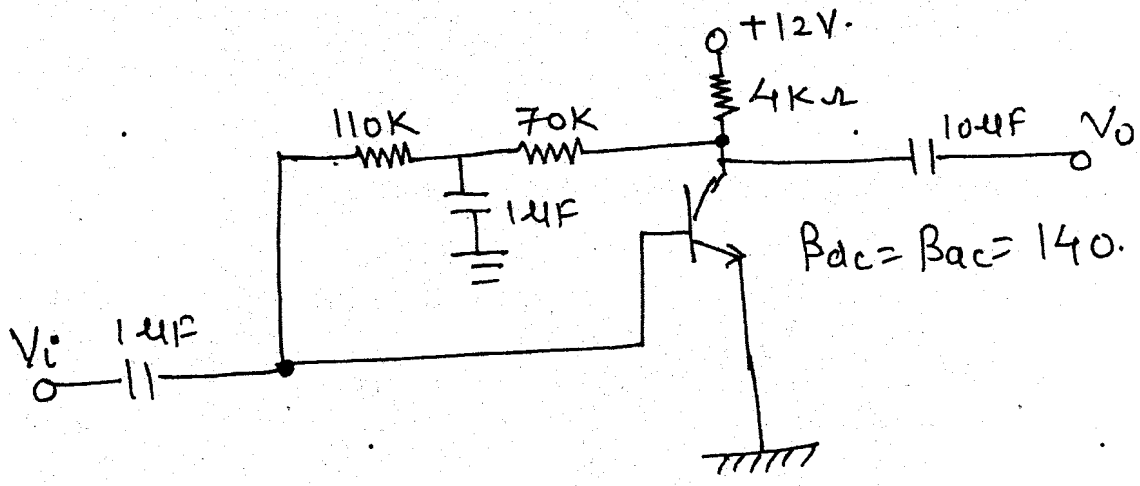
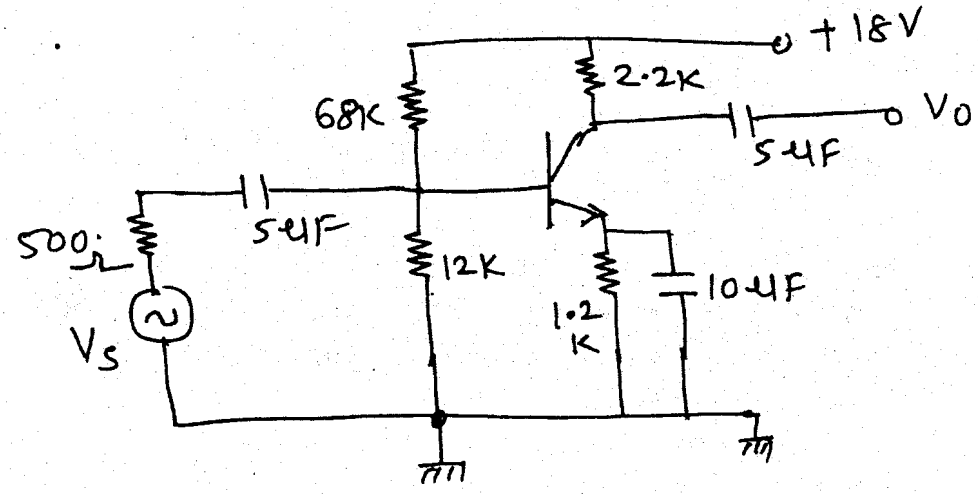
4. (a) Determine I_{BQ}, I_{CQ} and V_{CEQ} for the circuit shown below : **10**



(b) Explain the different Biasing Techniques for E-MOSFET. **5**

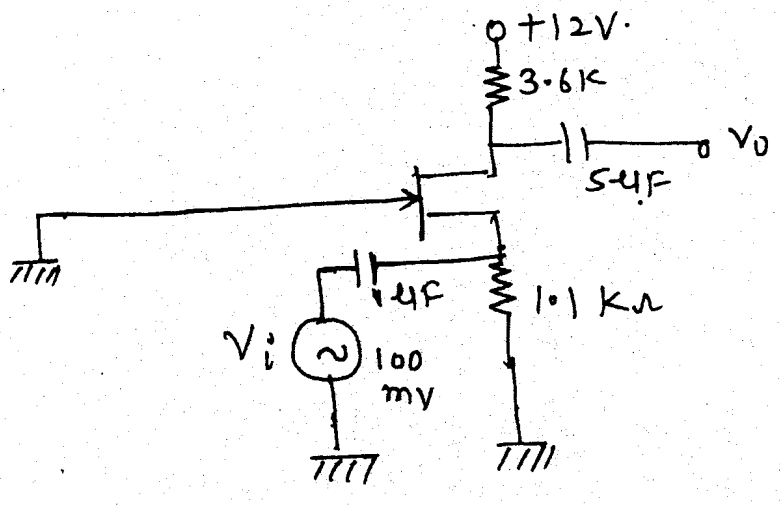
(c) Explain Base-width modulation in BJT. **5**

5. (a) Determine A_V, A_{vs}, Z_i, Z_o and A_I for the network shown in **figure**. **10**



For BJT
h_{fe} = 180
h_{oe} = 25 μs

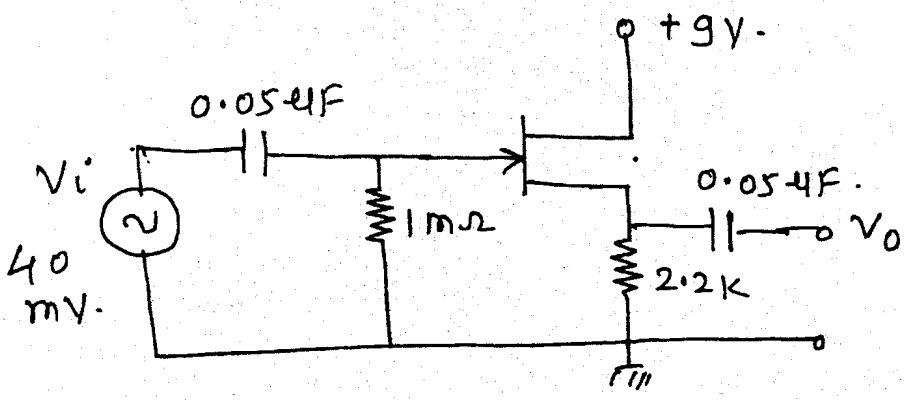
(b) Calculate Z_i, Z_0, and output voltage V_0 if V_i = 100 mV, for circuit shown below :– **10**



For JFET
I_{DSS} = 10 mA
V_P = –4V
γ_d = 40 kΩ.

6. (a) Draw the neat diagram of a JFET CS amplifier with unbypassed and derive the expression for the voltage gain, input Impedance and out-put Impedance. **10**

(b) Calculate the voltage gain and input and output Impedances for the circuit shown below : **10**



For JFET
I_{DSS} = 16 mA
V_P = –4 V
Y_{OS} = 25 μs

7. Write short notes on the following :– **20**

(a) V-MOSFET contruction and characteristic
(b) Voltage multiplier
(c) Photodiode operation and application
(d) Hybrid π-equivalent circuit of a BJT.

DATA SHEET

Transistor type	Pdmax @ 25°C Watts	Icmax @ 25°C Amps	$V_{CE}^{(sat)}$ volts d.c.	V_{CBO} volts d.c.	V_{CEO} (Sus) volts d.c.	V_{CER} (Sus) volts d.c.	V_{CEX} volts d.c.	V_{BEO} volts d.c.	T_j max °C	D.C. current gain min	typ.	max.	Small Signal h_{fe} min.	typ.	max.	V_{BE} max.	θ_{fc} °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	35	0·05
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	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
BC147B	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9	—	—

Transistor type	hie	hoe	hre	θja
BC 147A	2·7 K Ω	18μ ℧	1·5 × 10^{-4}	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	3·2 × 10^{-4}	—
BC 147B	4·5 K Ω	30μ ℧	2 × 10^{-4}	0·4°C/mw
ECN 100	50 Ω	—	—	—
ECN 149	15 Ω	—	—	—
ECN 055	12 Ω	—	—	—
2N 3055	6 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	3·5	4·0
Ids max. mA	10	9·0	8·3	7·6	6·8	6·1	5·4	4·2	3·1	2·2	2·0	1·1	0·5	0·0
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	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	0·0	0·0

N-Channel *JFET*

Type	V_{DS} max. Volts	V_{DG} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{mo} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ ℧	6	50 KΩ	2 mW/°C	0·59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ ℧	2·5	50 KΩ	—	0·59° C/mW

1/12/2011 SE Sem - III (ETRX)
Engg. maths III

Con. 6039-11. **MP–4093**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Answer any **four** questions out of the remaining **six** questions.
(3) **Figures** to **right** indicate **full** marks.

1. (a) Prove that $f(z)=(x^3-3xy^2+2xy)+i(3x^2y-x^2+y^2-y^3)$ is analytic and find $f'(z)$ & $f(z)$ in terms of z 5

(b) Find the Fourier series expansion for $f(x)=|x|$, *in* $(-\pi,\pi)$ Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}\cdots\cdots$ 5

(c) Find the inverse Laplace transform of $\frac{e^{-\pi s}}{s^2-2s+2}$ 5

(d) If $\{f(k)\}=\{2^0,2^1,2^3,\cdots\cdots\}$ find $Z\{f(k)\}$. 5

2. (a) Evaluate $\int_0^\infty e^{-2t}\sinh t\,\frac{\sin t}{t}\,dt$ 6

(b) Find the Fourier series expansion for $f(x)=\left(\frac{\pi-x}{2}\right)^2$ in the interval $0\le x\le 2\pi$ & $f(x+2\pi)=f(x)$ Also deduce that $\frac{\pi^2}{6}=\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}\cdots\cdots$ 7

(c) Show that $\begin{bmatrix}1 & -\tan\theta/2\\ \tan\theta/2 & 1\end{bmatrix}\begin{bmatrix}1 & \tan\theta/2\\ -\tan\theta/2 & 1\end{bmatrix}^{-1}=\begin{bmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{bmatrix}$ 7

3. (a) Find Laplace Transform of following

i) $\int_0^t \frac{1-e^{-au}}{u}\,du$ ii) $(t\sinh 2t)^2$. 6

(b) Find non-singular matrices P & Q s.t. PAQ is in Normal form . Also find rank of A & A^{-1}.

$$A=\begin{bmatrix}1 & 3 & 3\\ 1 & 4 & 3\\ 1 & 3 & 4\end{bmatrix}$$ 7

(c) Evaluate by Green's theorem $\int_C[(3x^2-8y^2)\,dx+(4y-6xy)\,dy]$ where C is the boundary of the region bounded by $y=\sqrt{x}$, $y=x^2$. 7

4. (a) Obtain complex form of Fourier series for the functions $f(x)=e^{ax}$ *in* $(0,a)$ 6

(b) For what value of λ the equations $x+y+z=1$, $x+2y+4z=\lambda$, $x+4y+10z=\lambda^2$ have a solution and solve them completely in each case. 7

(c) Find inverse Laplace Transform of following

i) $\log\left(1+\frac{a^2}{s^2}\right)$ ii) $\frac{s}{(s+1)^2(s^2+1)}$ 7

[TURN OVER

5. (a) Prove that $u = e^x \cos y + x^3 - 3xy^2$ is harmonic. 6

(b) Determine the linear dependence or independence of vectors $[2, -1, 3, 2]$, $[1, 3, 4, 2]$, & $[3, -5, 2, 2]$ Find the relation between them if dependent. 7

(c) Using Fourier Cosine integral prove that $e^{-x}\cos x = \frac{2}{\pi}\int_0^\infty \frac{(\omega^2+2)}{(\omega^4+4)}\cdot\cos\omega x\, d\omega$ 7

6. (a) Obtain half-range sine series for $f(x) = x(2-x)$ *in* $0 < x < 2$ 6

(b) Find the bilinear transformation which maps the points $0, i, -2i$ of z-plane on to the points $-4i, \infty, 0$ respectively of w-plane. Also obtain fixed points of the transformation. 7

(c) Verify Stoke's theorem for $\overrightarrow{F} = yz\,i + zx\,j + xy\,k$ and c is the boundary of the circle $x^2 + y^2 + z^2 = 1, z = 0$. 7

7. (a) Find inverse Z-transform of $F(z) = \frac{z}{(z-1)(z-2)}$, $|z| > 2$ 6

(b) Find the analytic function $f(z) = u + iv$ in terms of z if $u - v = e^x(\cos y - \sin y)$ 7

(c) Using laplace transform solve the following differential equation with given condition. $(D^2 - 2D + 1)x = e^t$, *with* $x = 2, Dx = -1$, *at* $t = 0$ 7

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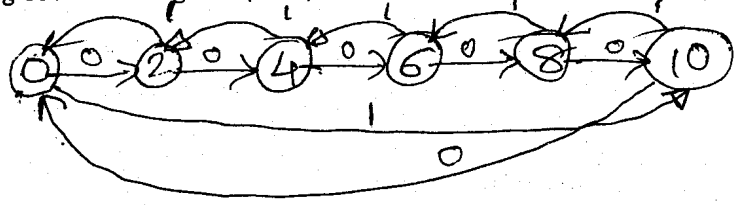
12/12/11 SE ETRX Sem-III (CR.)
Digital System Design-I

AGJ 2nd half (c+) 47

Con. 6485-11. **MP–4096**

(3 Hours) **[Total Marks : 100**

Note	1.) Question number 1 is compulsory. 2.) Attempt any four questions out of remaining ones. 3.) Assume suitable data where ever required. 4.) All questions 1 through 1 to 7 carries equal weight age.
Q. 1A	Convert following binary numbers to their equivalent hex numbers. i.) 10100110101111 ii.) 0.00011110101101
Q. 1B	Subtract i.) $(5C)_{16}$ from $(3F)_{16}$ ii.) $(7A)_{16}$ from $(C0)_{16}$
Q. 1C	Explain CMOS inverter along with circuit diagram and transfer characteristics.
Q. 1D	Explain 3 bit down asynchronous counter with suitable timing diagram.
Q. 1E	Explain 1 bit NOR cell and its use in clocked SR FF design.
Q. 2A	Design following counter using D Flip Flop using synchronous technique.  Eliminate lock out condition and take counting order as $Q_A Q_B Q_C Q_D$
Q. 2B	Explain 5 stage twisted ring counter using circuit diagram and proper timing diagram.
Q. 3A	Design following Flip Flop using NAND cell M N Q_{n+1} 0 0 Q_n Bar 0 1 1 1 0 0 1 1 Q_n
Q. 3B	Obtain JK Flip Flop using above Flip Flop.
Q. 4A	Design binary to gray code converter using 2:1 multiplexer.
Q. 4B	Explain one digit BCD subtractor using 4 bits adder, use proper circuit diagram and sample data $(0001)_{BCD}$ - $(1000)_{BCD}$.
Q. 5A	Simplify following function using Quine Mc-clusky method $f(A,B,C,D,E,F)=\sum m(0,5,7,8,9,12,13,23,24,25,28,29,37,40,42,44,46,55,56,57,60,61)$
Q. 5B	Design a hexadecimal to binary encoder using 74148encoder and 74157 multiplexer.
Q. 6A	Briefly explain classification of logic families. Explain any one out of it with respect to circuit diagram, characteristics, advantages and disadvantages.
Q 6B	Briefly Explain IC 74180 using block diagram and function table. Obtain 16 bit even parity checker using suitable combination of 74180 ICs.
Q. 7	Write short note on 1.) Performance parameters of logic families. 2.) Application of shift registers in sequence detection. 3.) Static and dynamic Hazards in digital circuits.