SE / Sem-III / [redacted] / Exam - May - 2010

ETRX

Con. 3020-10. Sub:- Constrol System AN-2485

Dt:- 09/06/2010

(3 Hours) [Total Marks : 100

N.B. (1) Question No. **1** is **compulsory**.
(2) In total, solve **five** questions.
(3) Assume **suitable** data if **required**.

1. Attempt the following questions :— 20
   (a) Explain the differences between time response analysis and frequency response analysis.
   (b) With suitable example, compare the open loop and closed loop control system.
   (c) What is stability in control system ? List the various methods to determine the stability.
   (d) Draw the output response of :
      (i) Undamped
      (ii) Underdamped and
      (iii) Overdamped control system for unit step input.
   (e) Express mathematically and graphically —
      (i) Step Input
      (ii) Ramp Input
      (iii) Parabolic Input.

2. (a) Determine the output response of a second order underdamped control system subjected to unit step input. 10
   (b) Sketch the root locus for unity feedback control system : 10

$$G(s) = \frac{K}{s\left(s^2 + 2s + 2\right)}$$

3. (a) Explain the rules for sketching the root locus. Give example in support of each rule. 10
   (b) Calculate t_r, m_p, t_p and t_s for unity feedback system having $G(s) = \frac{10}{s(s+2)}$. 10

   Assume step input of 12 units.

4. (a) Explain time response specifications of second order underdamped system for unit step input. 10
   (b) Sketch the polar plot for the system having $G(s) = \frac{1}{s(s+1)^2}$. 10

5. (a) Draw the Nyquist plot for $G(s) = \frac{1}{(s+1)(s+2)}$. Determine Gm and phase crossover frequency. 10

(b) Sketch the Bode plot of a system having $G(s) = \frac{75(1+0\cdot2s)}{s(s^2+16s+100)}$. Also calculate GM and PM. 10

6. (a) Find the sustained oscillation frequency of a system represented by characteristics equation, 10

$s^6 + 2s^5 + 8s^4 + 20s^2 + 16s + 16 = 0$

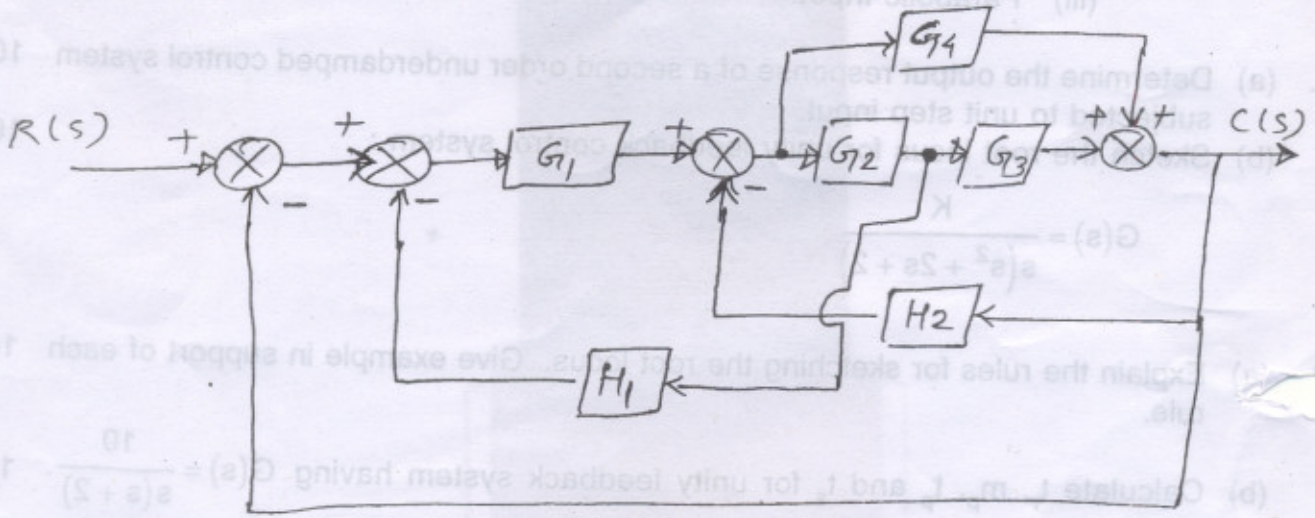
Comment on stability.

(b) Write short notes on :— 10

(i) Synchros and

(ii) PI and PD Controllers.

7. (a) Determine the transfer function of the system shown by following block diagram :— 10



(b) Verify your answer of (a) above using Signal Flow Graph Technique. 10

S.E. Electronics Sem III /

VT-April-10-7(1)

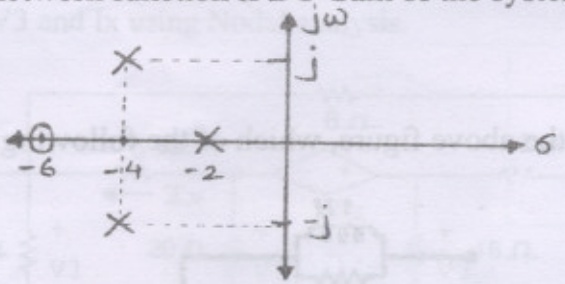
Electrical Network Analysis & Synthesis.

Con. 3024–10. **AN–2488**

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

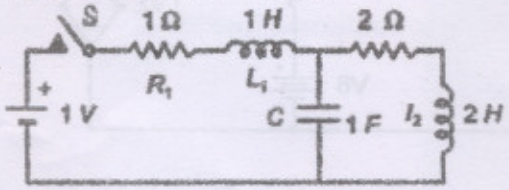
N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from Q. Nos. **2** to **7**.
(3) Assume **suitable** data wherever **necessary.**
(4) **Figures** to the **right** indicate **full** marks.

Q.1 (a) Determine the network function if DC Gain of the system is 100 and pole-zero diagram is as shown. [4M]



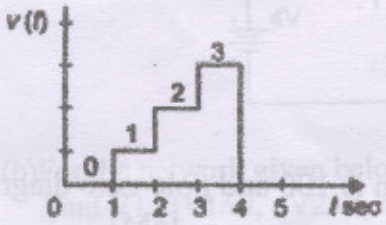
(b) Express the hybrid parameters in terms of impedance parameters. [4M]

(c) In the given figure network, there is no initial current through L.S and no initial voltage across C, and the switch 'S' is closed at time t = 0. The current i_{L1}, in the inductor L1 and the voltage V_C across C are calculated at t = 0 and at t = ∞. Which of the following sets of results is correct? [4M]

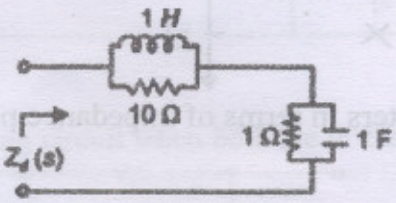


	$iL_1(0)$	$iL_1(\infty)$	$Vc(0)$	$Vc(\infty)$
(a)	1/3A	1/3A	2/3V	2/3A
(b)	0	1/3A	0	1V
(c)	1/3A	0	2/3 V	0
(d)	0	1/3A	0	2/3 V

(d) Find the Laplace Transform of the waveshape shown. [4M]

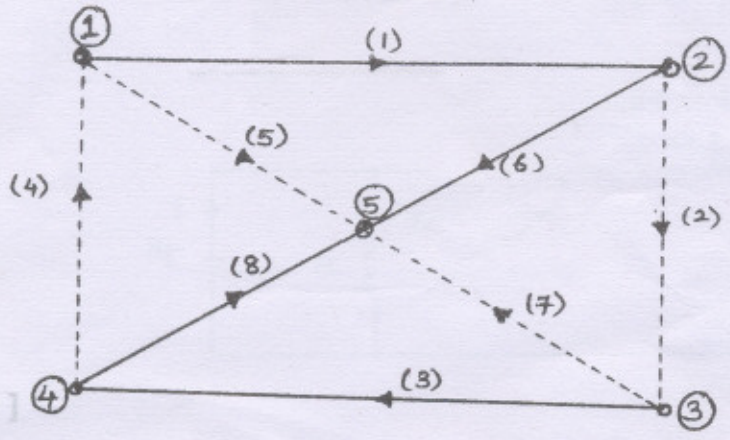


(e) For the network shown in the above figure, which of the following statements are true? [4M]

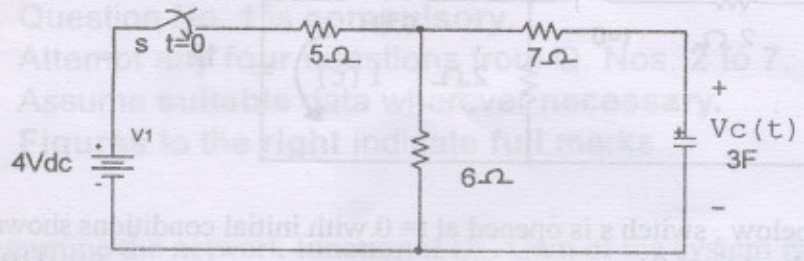


1. Lim $Z_d(s)$ = 1 ohm
   $s \to 0$
   Lim $Z_d(s)$ = 10 ohm
   $s \to \infty$
2. Lim $Z_d(s)$ = 10ohm
   $s \to 0$
   Lim $Z_d(s)$ = 1 ohm
   $s \to \infty$
3. Zd (s) has two real poles and two complex conjugate zeros.
4. Zd (s) has two complex conjugate poles and two complex conjugate zeros.

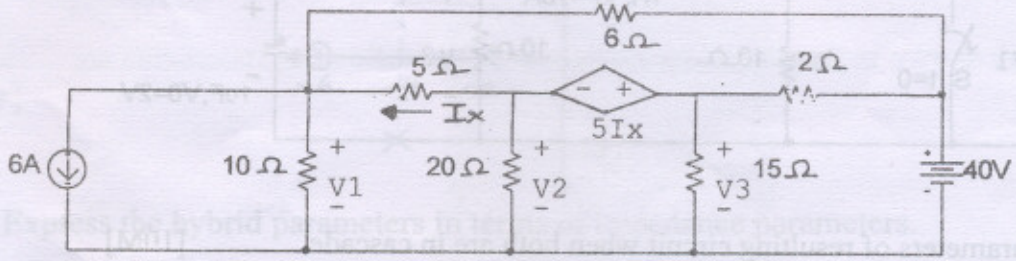
Q.2 (a) Write A, B and Q matrices for the graph shown. [10M]



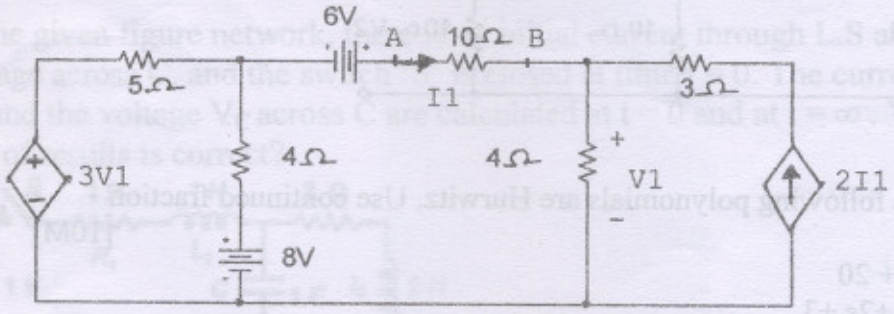
Q.2 (b).For the network shown in the figure below determine Vc(t) the switch S is closed at time t=0 with zero initial condition. [10M]



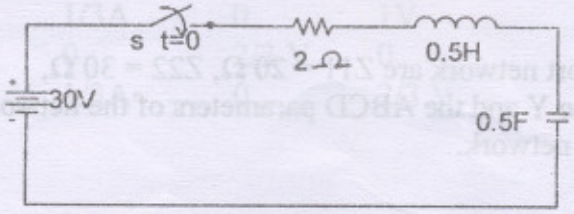
Q.3 (a) Find V1, V2, V3 and Ix using Nodal analysis. [10M]



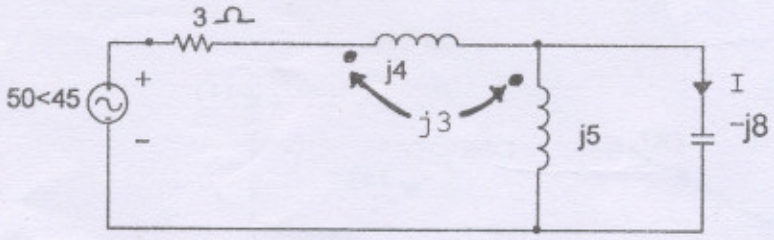
Q.3 (b) Find I1 through 10 Ω by Thevenin's theorem. [10M]



Q.4 (a) Obtain i(t) for t>= 0 and sketch the current for the network shown in the figure Also draw equivalent circuit at t = 0+ and t = ∞. [10M]



Q.4 (b) For the circuit below, Find I. [10M]



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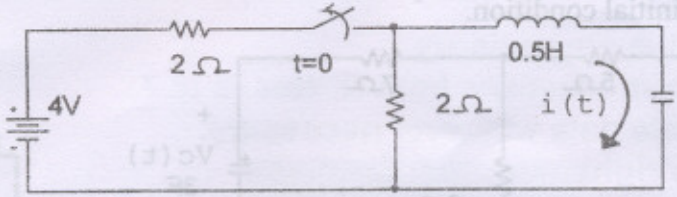
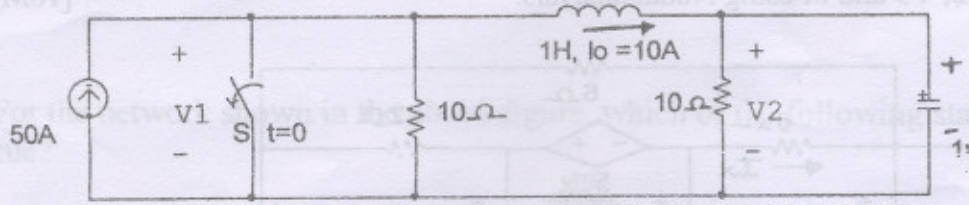
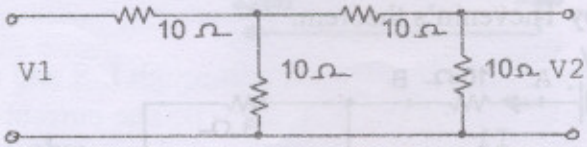
Q.5 (a) Using Laplace transform, find i (t). [10M]



Q.5 (b)For the network given below , switch s is opened at t= 0 with initial conditions shown. Find V1, dV1/dt, dV2/dt, at time 0+. [10M]



Q.6 (a) Find the T parameters of resulting circuit when both are in cascade. [10M]



Q.6 (b) Test whether the following polynomials are Hurwitz. Use continued fraction expansion [10M]

$P(S) = s^3 + 4s^2 + 5s + 20$

$Q(S) = s^4 + s^3 + 4s^2 + 2s + 3$

Q. 7 (a) $Z(s) = \dfrac{(S+4)}{(S+2)(S+6)}$ in Cauer I and foster I form. [10M]

Q. 7 (b) The Z parameters of a 2 port network are Z11 = 20 Ω, Z22 = 30 Ω, Z12 = Z21 = 10 Ω. Find the Y and the ABCD parameters of the network. Also find its equivalent T- network. [10M]

S.E. Electronics Sem III / Exam

Engineering Mathematics III

Con. 3029-10. **AN-2492**

(3 Hours) [Total Marks : 100

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

1. (a) Prove that : 5

$$\int_0^\infty e^{-st}\left(\frac{\sin at + \sin bt}{t}\right) dt = \pi - \tan^{-1}\left(\frac{s(a+b)}{ab - s^2}\right)$$

(b) Find Fourier transform of 5

$$f(x) = 1 - x^2, \quad |x| \le 1$$
$$= 0, \quad |x| > 1$$

(c) If A is nonsingular square matrix of order n, then show that : 5

$$|\text{adj adj } A| = |A|^{(n-1)^2}.$$

(d) Find the bilinear transform which maps the points $Z = (1, -1, \infty)$ onto the points $\omega = (1 + i, 1 - i, 1)$. 5

2. (a) Evaluate the following : 8

(i) $\int_0^\infty e^{-t} \sin^5 t \, dt$

(ii) $L\left\{ e^{-u} \int_0^t e^u \cos hu \, du \right\}$

(b) Express the function :— 6

$$f(x) = -e^{kx}, \; x < 0$$
$$= e^{-kx}, \; x > 0$$

as Fourier Integral and hence prove that $\int_0^\infty \frac{\omega \sin \omega x}{\omega^2 + k^2} = \frac{\pi}{2} e^{-kx}$

if $x > 0$, $k > 0$.

(c) Find Z-transform of $f(k) = \sin \alpha k$, $k \ge 0$ where α is real. 6

3. (a) If f(z) is analytic function, prove that : 8

(i) $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) = 4 \frac{\partial^2}{\partial z \, \partial \bar{z}}$

(ii) $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) \log |f'(z)| = 0$

(b) Find Inverse Z-transform of $\frac{3z^2 + 2z}{z^2 - 3z + 2}$ for $1 < |z| < 2$ 6

(c) Find complex form of Fourier Series for :— 6

3. (a) If f(z) is analytic function, prove that : 8

(i) $$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) = 4 \frac{\partial^2}{\partial z \, \partial \bar{z}}$$

(ii) $$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) \log \left| f'(z) \right| = 0$$

(b) Find Inverse Z-transform of $\frac{3z^2 + 2z}{z^2 - 3z + 2}$ for $|<|z|<2$ 6

(c) Find complex form of Fourier Series for :— 6

$f(x) = 0, \; 0 < x < l$

$= a, \; l < x < 2l.$

[TURN OVER

4. (a) Use Laplace transform to solve $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 1$ where $y(0) = 0$, $y^1(0) = 1$. 8

(b) If $f(z) = u + iv$ is analytic and $u - v = e^x (\cos y - \sin y)$, find $f(z)$ in terms of z. 6

(c) Show that $\bar{F} = (ye^{xy} \cos z)\, i + (xe^{xy} \cos z)\, j - (e^{xy} \sin z)k$ is irrotational and find the scalar potential for $\bar{F}$. 6

5. (a) Find Fourier expression of $f(x) = x^2$ in $-\pi \leq x \leq \pi$ and hence prove that : 8

(i) $\frac{\pi^2}{6} = \sum_1^\infty \frac{1}{n^2}$

(ii) $\frac{\pi^2}{12} = \sum_1^\infty \frac{(-1)^{n+1}}{n^2}$

(iii) $\frac{\pi^4}{90} = \sum_1^\infty \frac{1}{n^4}$

(b) State convolution theorem for Laplace transform and hence find : 6

$$L\left\{\frac{s+2}{(s^2+4s+8)^2}\right\}.$$

(c) Using Laplace transform, evaluate $\int_0^\infty e^{-2t} (1 + 2t - 3t^2 + 4t^3)\, H(t-1)\, dt$. 6

6. (a) If A and B are matrices given below, reduce A to normal form and find rank of A and hence find rank of $3A^2 - AB$: 8

$$A = \begin{bmatrix} 0 & 2 & 1 & 2 \\ 0 & 2 & 1 & 1 \\ 2 & 6 & 3 & 5 \\ 2 & 4 & 2 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 6 & 3 & 6 \\ 0 & 4 & 3 & 3 \\ 6 & 18 & 7 & 15 \\ 6 & 12 & 6 & 10 \end{bmatrix}$$

(b) Find the work done in moving the particle along the curve $r = (e^t \cos t)\, i + (e^t \sin t)\, j$ from the point (1,0) to $(e^{2\pi}, 0)$ in the force field $\bar{F} = \frac{xi + yj}{(x^2 + y^2)^{3/2}}$. 6

(c) Find the image of the circle $|z| = k$ under the transformation $\omega = 3z + 4 + 2i$. 6

7. (a) Determine λ and μ for which the system 8

$$3x - 2y + z - \mu = 0$$
$$5x - 8y + 9z - 3 = 0$$
$$2x + y + \lambda z + 1 = 0$$

have : (i) no solution
(ii) unique solution
(iii) Infinite number of solutions. Also find infinite solutions of the systems.

(b) Show that the following set of functions is orthogonal over $(-l, l)$ 6

$$S = \left\{ 1, \cos \frac{n\pi x}{l}, \sin \frac{n\pi x}{l}, n \in \pi V \right\}.$$

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

S.E. Electronic SEM III

Digital System Design-I

31 May 2010

Con. 3011-10. AN–2482

(3 Hours) [Total Marks : 100

N. B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **four** questions from remaining **six** questions.

1. (a) What are self complementing codes ? Explain with two examples. 20
(b) Simplify following expression using boolean laws and draw logic diagam using AOI gates.

$$F = A\left(B + C\left(\overline{AB + AC}\right)\right)$$

(c) If $\overline{Q}$ output of a D–type flipflop is connected to 'D' input, it act as a toggle switch. Verify.
(d) Implement following expression using 2 : 1 MUX
$y = \overline{A} + B$, Use 'B' as a select input.

2. (a) Minimize the following logic function using k-Map and realize using NOR gate. 10
$f(A, B, C, D) = \Sigma m\,(1, 3, 5, 8, 9, 11, 15) + d\,(2, 13)$
(b) A bank Vault has three locks with a different key for each lock. Each key is owned by different person. In order to open door, at least two people must insert their keys into associated locks. The signal line A, B and C are '1', if there is key inserted into lock 1, 2 and 3 respectively. Write an equation and draw logic diagram for output Z = 1, if door should open. 10

3. (a) Design 3–bit binary to Gray code converter circuit using 3 line to 8 line decodes and gates. 10
(b) Realize the logic function in SOP form using Quine-mccluskey method. 10
$f(A, B, C, D) = \pi\, m\,(2, 7, 8, 9, 10, 12)$

4. (a) Design 10–bit even parity checker using one 74180 and an Ex-OR gate. 10
(b) Design a 4–bit Adder/Subtractor circuit using 7483 with ADD/SUB control line. 10

5. (a) Consider M-N Flipflop which is J–K flipflop with an inverter between input K and external input N. 10
(i) Obtain the characteristics table
(ii) How to realize D-flipflop from M–N flipflop.
(b) Define following parameter for CMOS family and gives values. 10
(i) Fan out
(ii) Propagation delay
(iii) Noise Margin
(iv) Current parameter.

6. (a) Design mod-10 ripple counter using J–K flipflop and explain slitch problem. 10
(b) Design mod-5 synchronous counter using J-K flipflop. What happens if the counter enters in unused state ? 10

7. (a) Explain working of 4–bit twisted ring counter. Draw its timing diagram. 10
(b) Explain operation of CMOS NAND gate. 6
(c) What is static hazards in a combinational digital circuit ? 4

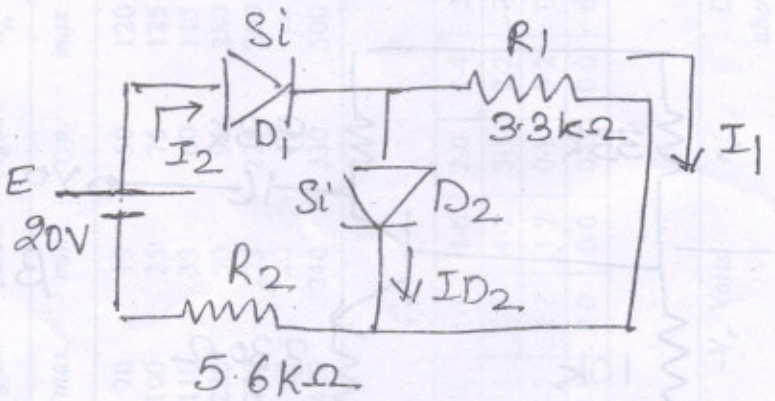
S.E. Electronics SEM III Exam 25 May 2010

Con. 3001-10. Basics of Electronic circuits AN-2479

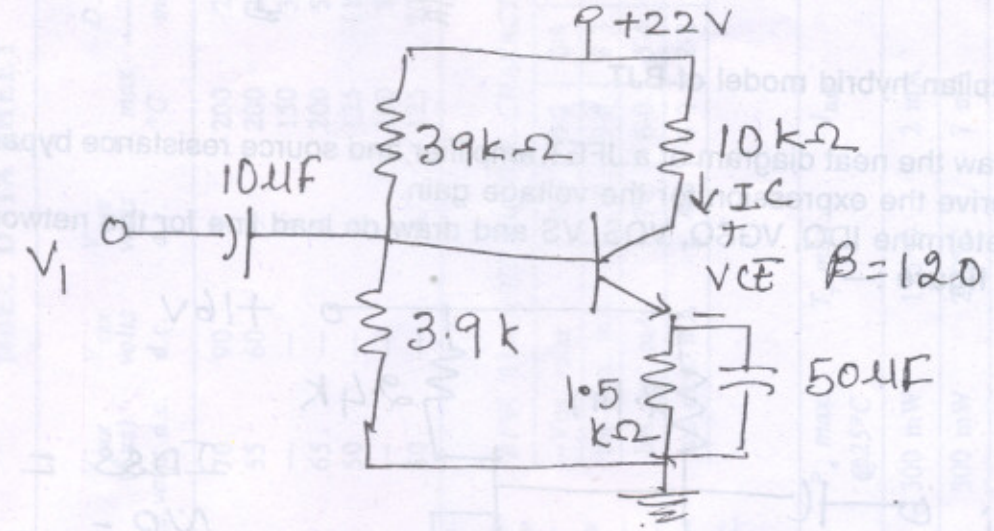
(3 Hours) [Total Marks : 100

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **four** out of remaining **six** questions.
(3) Assume any suitable data wherever **required**.

1. (a) Determine the Currents I_1, I_2 and ID_2 for the following network :— 5



(b) Determine the dc bias Voltage VCE and the current IC for the following configuration :— 5



(c) Derive the condition for fero temperature drift biasing of FET. 5
(d) What is the maximum reverse voltage (PIV) across a diode in :— 5
(i) HWR
(ii) FWR with center tapped transformer
(iii) Bridge type rectifier.

2. (a) Design a Single stage BJT CE Amplifier for the following requirements :— 15
Av ≥ 100, Zi > 3K Ω, Vcc = 18 V.
(b) Determine Av, Zi and Zo for designed circuit. 5

2. (a) Design a Single stage BJT CE Amplifier for the following requirements :— 15
$Av \geq 100$, $Zi > 3K\ \Omega$, $Vcc = 18$ V.

(b) Determine Av, Zi and Zo for designed circuit. 5

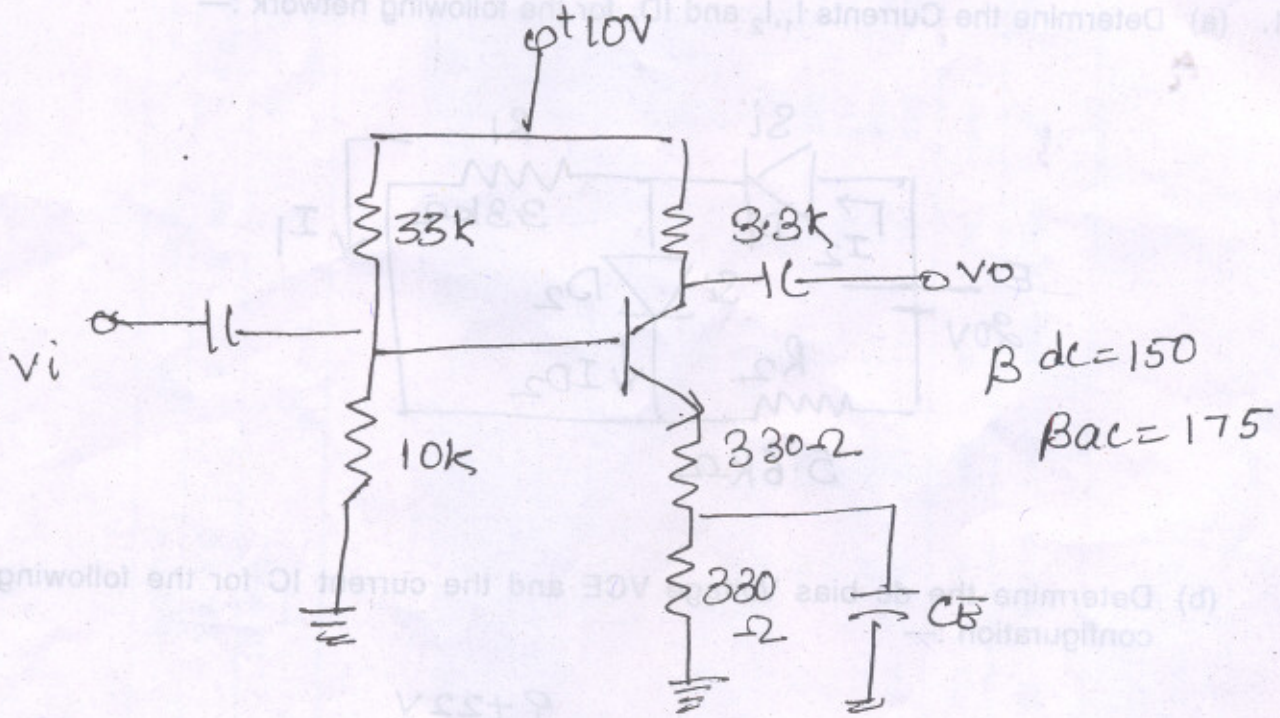
3. (a) Explain the operation of fullwave rectifier and draw the o/p wareform for $V_L$dc and $I_L$dc. 10

(b) Derive an Expression for ripple factor for capacitor filter with center tapped Full wave rectifier. 10

If a circuit of fullwave center tapped rectifier with capacitor filter employs a load $R_L = 100\ \Omega$ and $C = 1050\ \mu F$. Calculate the ripple factor.

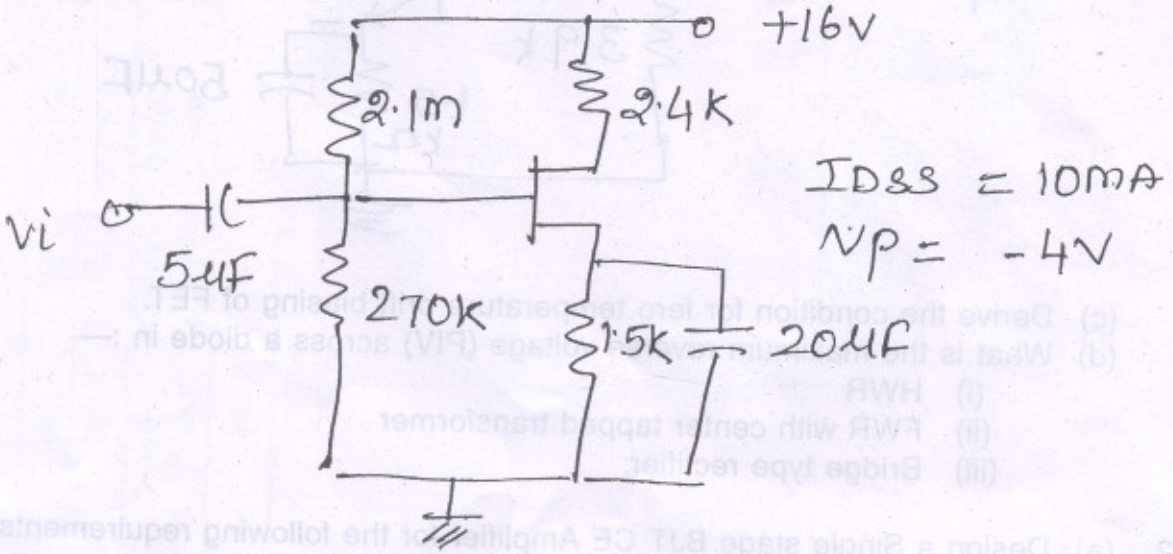
[TURN OVER

4. (a) For the circuit shown in **figure** determine :— **15**
   (i) Operating point
   (ii) Voltage gain
   (iii) Input impetance
   (iv) What will be Voltage without CE ?
   (v) What will be i/p impetance without CE ?



   (b) Explian hybrid model of BJT. **5**

5. (a) Draw the neat diagram of a JFET amplifier and source resistance bypassed and derive the expression for the voltage gain. **10**
   (b) Determine IDQ, VGSQ, VDS, VS and draw dc load line for the network shown in **figure** :— **10**



6. (a) Explain Construction, Working principle and characteristic of D Mosfet. **10**
   (b) Explain different biasing techniques for E MOSFET. **5**
   (c) Compare MOSFET and FET. **5**

7. Write short notes any **three** of the following :— **20**
   (a) Voltage multiplier

DBEC 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 min.	typ.	h_{fe} max.	V_{BE} max.	θ_{fc} °C/W	D a 2 V
2N 3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	
ECN 055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	
ECN 149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	
ECN 100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	
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	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	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_{j}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ ℧	6	50 KΩ	2 mW/°C	0·59°C
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ ℧	2·5	50 KΩ	——	0·59° C