Q.2 a. In the circuit of Fig. 1, $V_A = 2V$, $I_A = 2A$, $R_1 = 4\Omega$ and $R_2 = 3\Omega$. Find the Thevenin equivalent voltage V_{th} and impedance Z_{th} for the network to the left of terminals 1, 2.

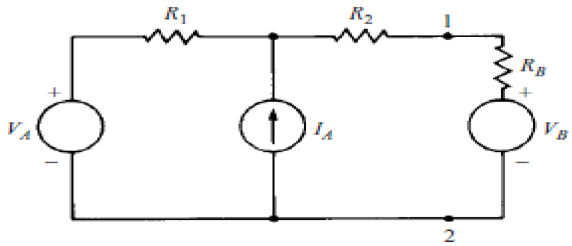


Fig.1

Answer:

Q:2

a. • With terminals 1-2 open circuited, no current flows through R_2, by using KVL

$V_{th} = V_{12} = V_A + I_A R_1 = 2 + (2 \times 4) = 10\ V.$

(2x3)

• Z_{th} – with VA replaced by a short and IA replaced by an open circuit.

$Z_{th} = R_{Th} = R_1 + R_2 = 4 + 3 = 7\Omega.$

b. Explain Duality. Obtain dual network for the circuit shown in fig.2.

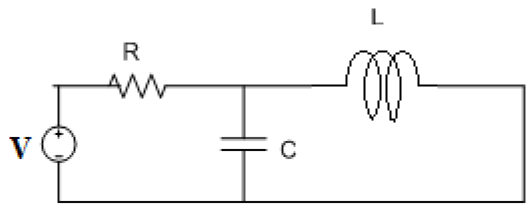


Fig.2

Answer:

Duality :- Networks which have identical describing differential equations are known as dual of each other, and the concept is known as DUALITY.

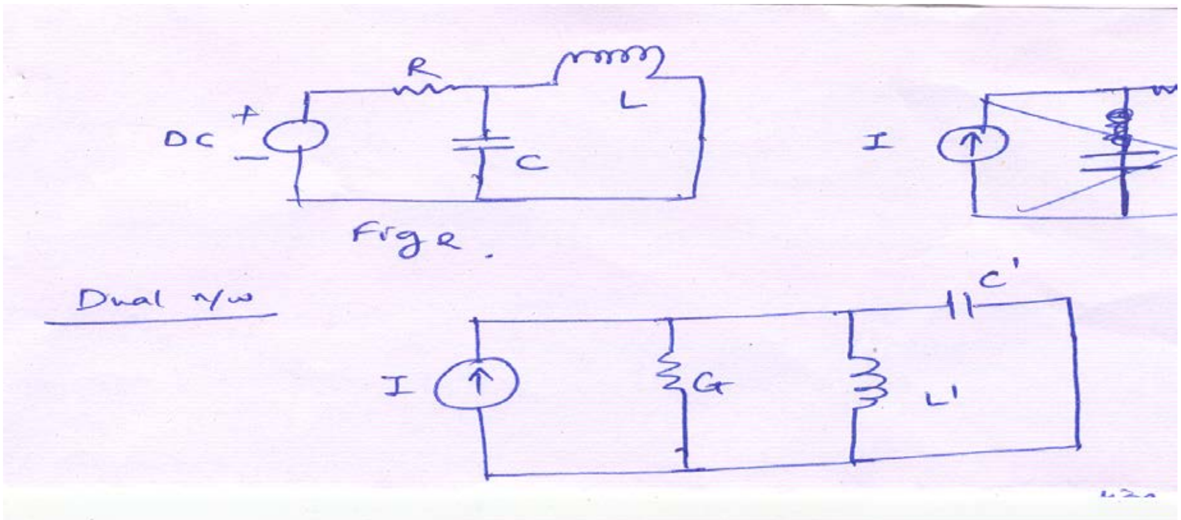
eg. dual of elements

R ↔ G   voltage source ↔ current source,

L ↔ C

Q.3 a. Draw and explain switching characteristics of a diode.

Answer:



b. Plot the output voltage V_0

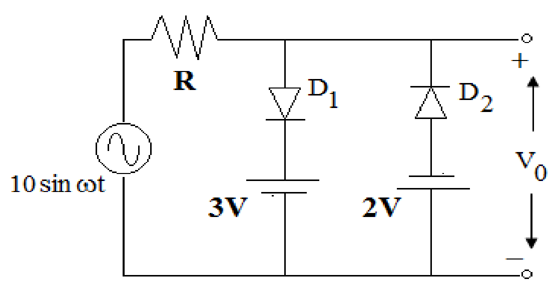


Fig.3

Answer: Topic 1.14 of Text Book 1

c. Write short note on:
(i) Transition and Diffusion capacitance
(ii) Zener diode as voltage regulator

Answer: Topic 1.13 of Text Book 1

Q.4 a. Explain the construction and operation of a n-channel E-MOSFET with suitable diagram and characteristics.

Answer: Topic 2.3 of Text Book 1

b. The transistor of Fig.4 is provided with the fixed and self biased emitter resistance with Rc = 4 k Ω, R_E = 2 kΩ, V_{cc} = 32 V and I_c = 4 mA.
(i) Calculate the value of R_B if β = 100
(ii) What will be the percentage change in I_C if actual β=40?

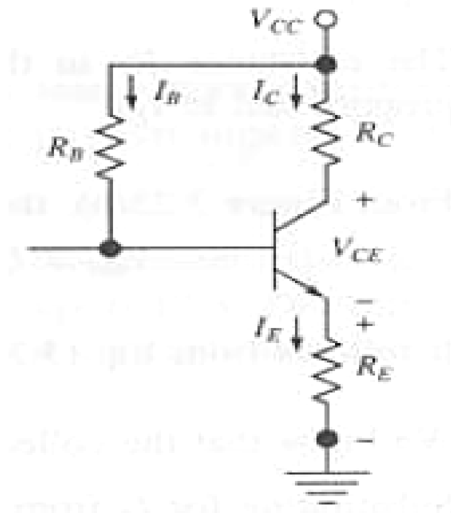


Fig. 4

Answer:

	Condition.	Emitter junction	Collector junction	Region of Operation	application
i)	I FR	FB	RB	Active.	→ Amplification
ii)	II FF	FB	FF	Saturation	→ Closed switch
iii)	III RR	RB	RB	Cut-off	→ open switch
iv)	IV RF	RB	FB	Inverted	→ Not used.

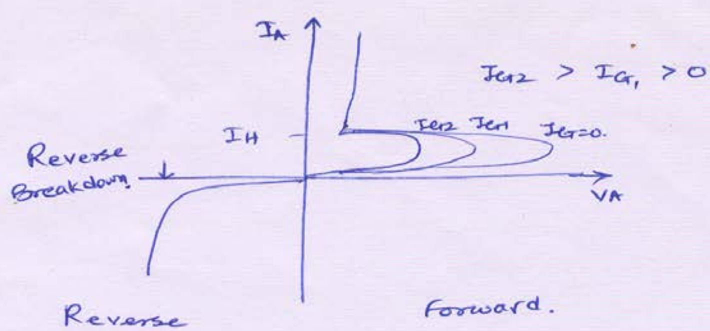
(∵ Very poor transistor action).

c. Draw V-I characteristics of an SCR.

Answer:

Q:4 c Contd. V-I chara. of SCR

104/11 (3/5)



I_H = Holding current

I_G = Gate current.

Q.5 a. Draw the small-signal model of Emitter follower and obtain the expression of voltage gain, current gain, input impedance and output impedance.

Answer:

Q.5 (a) Given. $R_C = 4k\Omega$ $R_E = 2k\Omega$ $V_{CC} = 32V$ and $I_C = 4mA$.

(i) Value of R_B if $\beta = 100$.

$$I_B = \frac{I_C}{\beta} = \frac{4}{100} = 0.04mA.$$

$$V_{CC} = I_B R_B + V_{BE} + (I_B + I_C)R_E$$

$$32 = 0.04 \times R_B + 0.7 + (0.04 + 0.04)2$$

$\therefore R_B = 550k\Omega$

(ii) Actual $\beta = 40$; $\Delta I_C = ?$

$$32 = 550 I_B + 0.7 + (I_B + 4)2$$

$\therefore I_B = 0.04 mA$

$$I_C = I_B \times \beta = 40 \times 0.04 = 1.6mA.$$

$$\Delta I_C = 4 - 1.6 = 2.4mA$$

$= 60\%$ Reduction.

b. Explain working of a Darlington pair amplifier in detail.

Answer: Topic 3.9 of Text Book 1

c. Write short note on CMOS.

Answer: Topic 3.2 of Text Book 1

Q.6 a. Explain working of tuned amplifier. Also state its merit and application.

Answer: Topic 4.4 of Text Book 1

b. A certain BJT transistor has r_π = 2 kΩ and β= 50 at 1MHz and β = 2.5 at 20MHz. Determine f_T, f_β and C_π.

Answer:

(b) Given $r_\pi = 2k\Omega$ & $\beta = 50$ at 1MHz.
$\beta = 2.5$ at 20MHz.

$$f_T = \beta f_\beta = \beta_f \cdot f$$

$$f_T = 2.5 \times 20 = 50MHz.$$

$$f_\beta = \frac{f_T}{\beta} = 50/50 = 1MHz.$$

$$f_\beta = \frac{1}{2\pi C_\pi r_\pi}$$

$$1 \times 10^6 = \frac{1}{2\pi C_\pi 2\times10^3}$$

$$C_\pi = \frac{1}{2\pi \times 2\times10^3 \times 1\times10^6}$$

$C_\pi \approx 80 pF$

c. Write short note on cascaded amplifiers.

Answer: Topic 4.6 of Text Book 1

Q.7 a. Compare Class A, Class B, Class AB and Class C power amplifiers.

Answer: Topic 5.5 of Text Book 1

b. State performance parameters of power amplifier.

Answer:

i) Collector efficiency = ac power output / dc power input.

ii) Distortion —

iii) Power dissipation capability.

c. A transistor supplies 2W for a 5 kΩ load. The zero-signal dc collector current is 35 mA and rises to 40 mA when signal is applied. Determine the percent second- harmonic distortion.

Answer:

(c) $I_C = 35\,mA$

$I_C + B_0 = 40\,mA$ i.e.

i.e. $B_0 = 40 - 35 = 5\,mA$.

$P_1 = \frac{B_1^2 R_L}{2}$

$\Rightarrow B_1 = 28.3\,mA$

$B_2 = B_0 = 5\,mA$.

Second harmonic distortion.

$D_2 = \left|\frac{B_2}{B_1}\right| \approx \frac{5}{28.3} \times 100$

$= 17.66\,\%$ Ans.

Q.8 a. Define feedback. Which type of feedback is used for oscillator circuit? Discuss feedback's effect on input and output impedance.

Answer:

Q.8 (a)

Feedback :- The process by which a fraction of output energy of device (amplifier) is injected back to its input is called feedback.

(01 mark)

Type :- Positive Feedback :- Used for oscillator circuit.

negative feedback :- used for amplifier.

(01 mark)

Rest Part :- Topic 6.4. Ref(F).

b. A voltage series feedback amplifier has the following data: A = -500, R_i = 1.5 kΩ , R_o = 50 kΩ and β = (1/10). Calculate amplifier gain, input and output resistances. Also draw topology for the same

Answer:

(2×3)

(b) Given $A = -500$, $R_i = 1.5 k\Omega$, $R_o = 50 k\Omega$ and $\beta = 1/20$. (2×4)

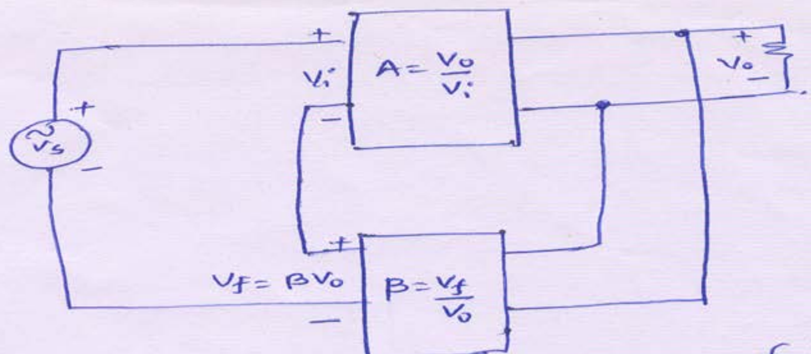
$1 + A\beta = 1 + 500 \times 1/20 = 26.$

$A_f = \frac{-A}{1+A\beta} = -\frac{500}{26}$

$A_f = 19.23$ amplifier gain.

R_{if} (input resi.) $= R_i (1 + A\beta) = 1.5 \times 26 = 39 k\Omega$

R_{of} (o/p resi.) $= \frac{R_o}{1+A\beta} = \frac{50}{26} = 1.92 kW.$



Topology for Voltage Series feedback.

Q.9 a. Write short notes:
(i) Integrated resistors
(ii) Integrated capacitors

Answer: Topic 9.9 & 9.10 of Text Book 1

b. State characteristics of IC components.

Answer: Topic 9.12 of Text Book 1

c. State levels of integration of IC fabrication.

Answer: Topic 9.14 of Text Book 1

TEXT BOOK

Electronic Devices and Circuits, I. J. Nagrath, PHI (2007)