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CMRIT

Internal Assessment Test 1 – Sept. 2018

Sub:	Analog Electronics					Sub Code:	17EC33	Branch:	ECE
Date:	08-09-18	Duration:	90 min's	Max Marks:	50	Sem / Sec:	3^{rd} / A, B, C		OBE

	Answer all FIVE FULL Questions	MARKS	CO	RBT
1	Derive an expression for input impedance, output impedance, voltage gain and current gain for voltage divider bias CE amplifier using re model.	[10]	CO1	L2
	(OR)			
	Derive an expression for input impedance, output impedance, voltage gain and current gain of an un-bypassed R_E CE amplifier using re model.	[10]	CO1	L2
2	Derive an expression for input impedance, output impedance, voltage gain and current gain for Fixed bias Configuration using approximate hybrid model.	[10]	CO1	L2
	(OR)			
	Derive an expression for current gain, voltage gain, input impedance and output impedance of transistor amplifier using h-parameters. (Complete Hybrid model)	[10]	CO1	L2
3	For the network shown in Fig.1 determine, (with $r_o = \infty\ \Omega$) i) r_e ii) Z_i iii) Z_o iv) A_v v) A_i	[10]	CO1	L3

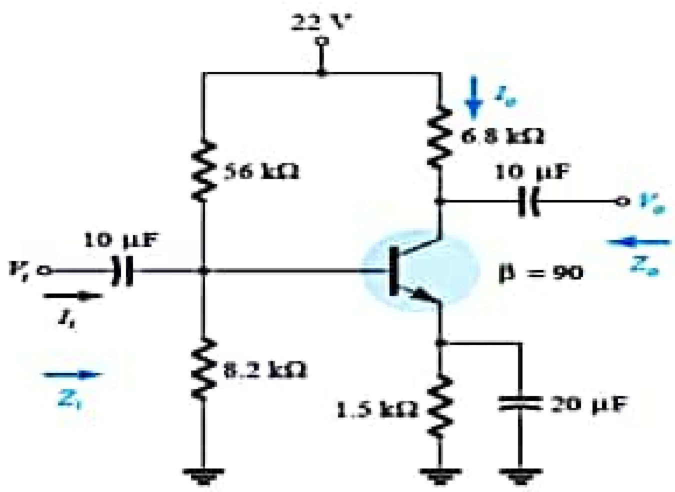


Fig: 1

4	Find input impedance, output impedance, voltage gain and current gain of emitter follower configuration where V_{CC}=10V, R_B=100KΩ, R_E=1KΩ, h_{ie}=1.1KΩ, h_{fe}=100. Use approximate hybrid equivalent model.	[10]	CO1	L3

5 (a) Calculate DC bias voltages and currents for the Darlington configuration shown in Fig.2 [05] CO1

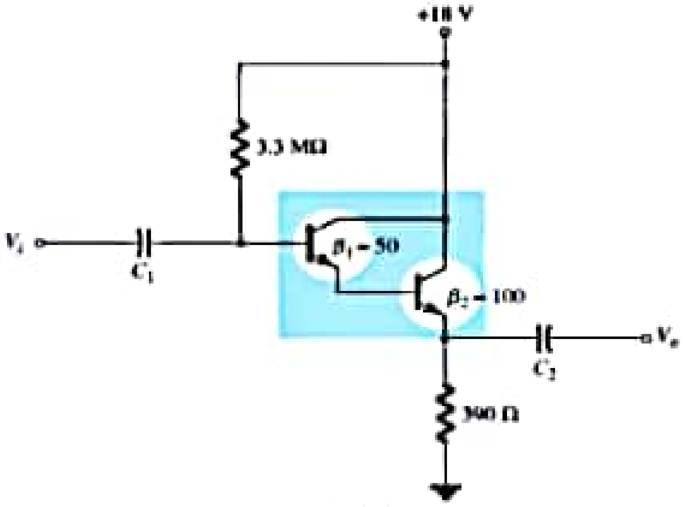


Fig: 2

(b) Calculate the output voltage (V_o) and Zener current in the regulator circuit shown in Fig.3 for $R_L = 1\ k\Omega$. [05] CO4

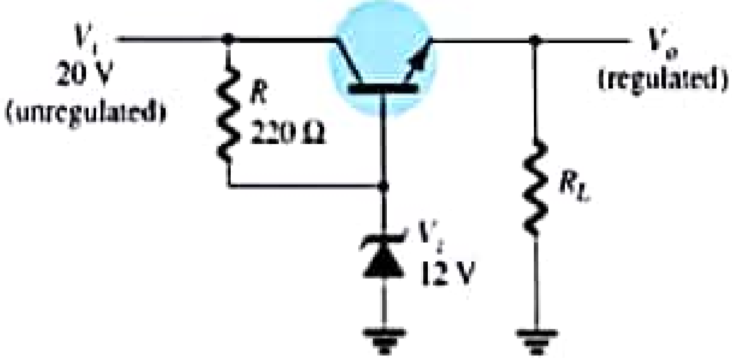


Fig: 3

*** ALL THE BEST ***

E.C.E

AE – IAT-I Solutions

Date: 11/09/18

(Q3)

(i) r_e using approximate approach

$$V_{th} = \frac{V_{CC} \times R_2}{R_1 + R_2} = \frac{22 \times 8.2k}{56k + 8.2k} = 2.81V$$

$$R_{th} = 8.2k \| 56k = 7.15k\Omega$$

$$I_B = \frac{V_{th} - V_{BE}}{R_{th} + (1+\beta) R_E} = \frac{2.81 - 0.7}{7.15k + (1+90)1.5k}$$

$$= 14.69 \mu A$$

$$I_E = (1+\beta) I_B$$

$$= (1+90) \times 14.69 \times 10^{-6}$$

= ~~1.34mA~~

$$= 1.34 mA$$

$$r_e = \frac{26mV}{I_E} = \frac{26mV}{1.34mA} = 19.40\Omega$$

(OR)

$$V_B = \frac{V_{CC} \times R_2}{R_1 + R_2} = \frac{22 \times 8.2k}{56k + 8.2k} = 2.81V$$

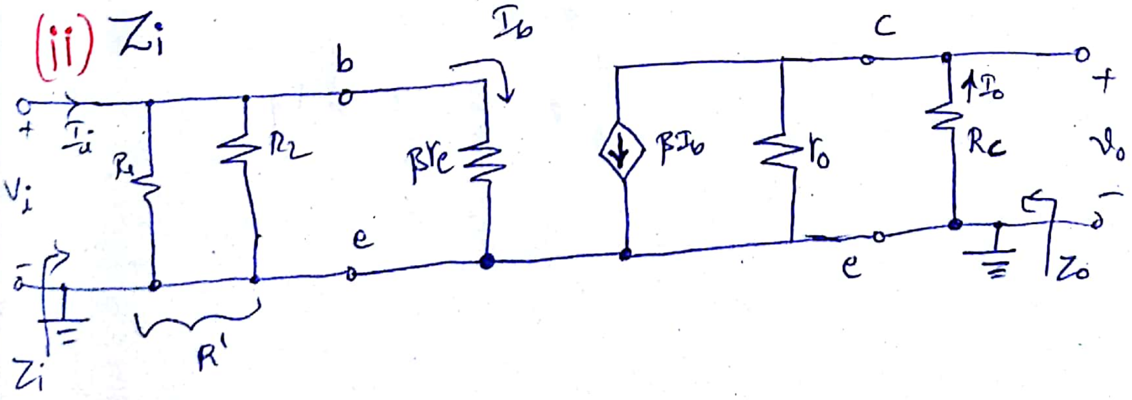
$$V_E = V_B - V_{BE} = 2.81 - 0.7$$

$$= 2.11V$$

$$I_E = \frac{V_E}{R_E} = \frac{2.11}{1.5k} = 1.41mA$$

$$r_e = \frac{26mV}{I_E} = 18.44\Omega$$

(ii) Z_i



(Q3)

$R' = R_1 || R_2 = 7.15K\Omega$

$Z_i = R' || \beta r_e = 7.15K || (90)(18.44)$

$= 7.15K || 1.66K = 1.35K\Omega$

$Z_i = 1.35K\Omega$

(iii) $Z_o = R_C = 6.8K\Omega$

(iv) A_v

$r_e = 18.44\Omega$

$A_v = -\frac{R_C || r_o}{r_e}$

$= -\frac{6.8K || \infty\Omega}{r_e}$

$\simeq \frac{-6.8K\Omega}{18.44\Omega} = -368.763$

$A_v \simeq -368.76$

$= 7.15K || (90)(19.40)$

$= 7.15K || 1.74K$

$Z_i = 1.39K\Omega$

$r_e = 19.40\Omega$

$A_v = -\frac{6.8K\Omega}{19.40\Omega} = -350.51$

$A_v \simeq -350.51$

(v) A_i $(r_o = \infty \Omega)$

Method ①

$$A_i \approx \frac{\beta R'}{R' + \beta r_e} \quad (\because r_o > 10 R_c)$$

$$\approx \frac{90 \times 7.15 K\Omega}{7.15K + 1.66K}$$

$$\approx 73.04$$

(OR)

Method ②

$$A_i = - A_v \cdot \frac{Z_i}{R_c}$$

$$= - \frac{(-368.76 \times 1.35K)}{6.8K}$$

$$= 73.20$$

$$A_i \approx \frac{\beta \cdot R'}{R' + \beta r_e}$$

$$\approx \frac{90 \times 7.15K}{7.15K + 1.74K}$$

$$\approx 72.38$$

(OR)

$$A_i = - \frac{-350.51 \times 1.39K}{6.8K}$$

$$= 71.64$$

finally:

$r_e = 18.44 \Omega$

$Z_i = 1.35 K\Omega$
$Z_o = 6.8 K\Omega$
$A_v = -368.76$
$A_i = 73.04$

$r_e = 19.40 \Omega$

$Z_i = 1.39 K\Omega$
$Z_o = 6.8 K\Omega$
$A_v = -350.51$
$A_i = 72.38$

(Q4)

Ans:

Given Data

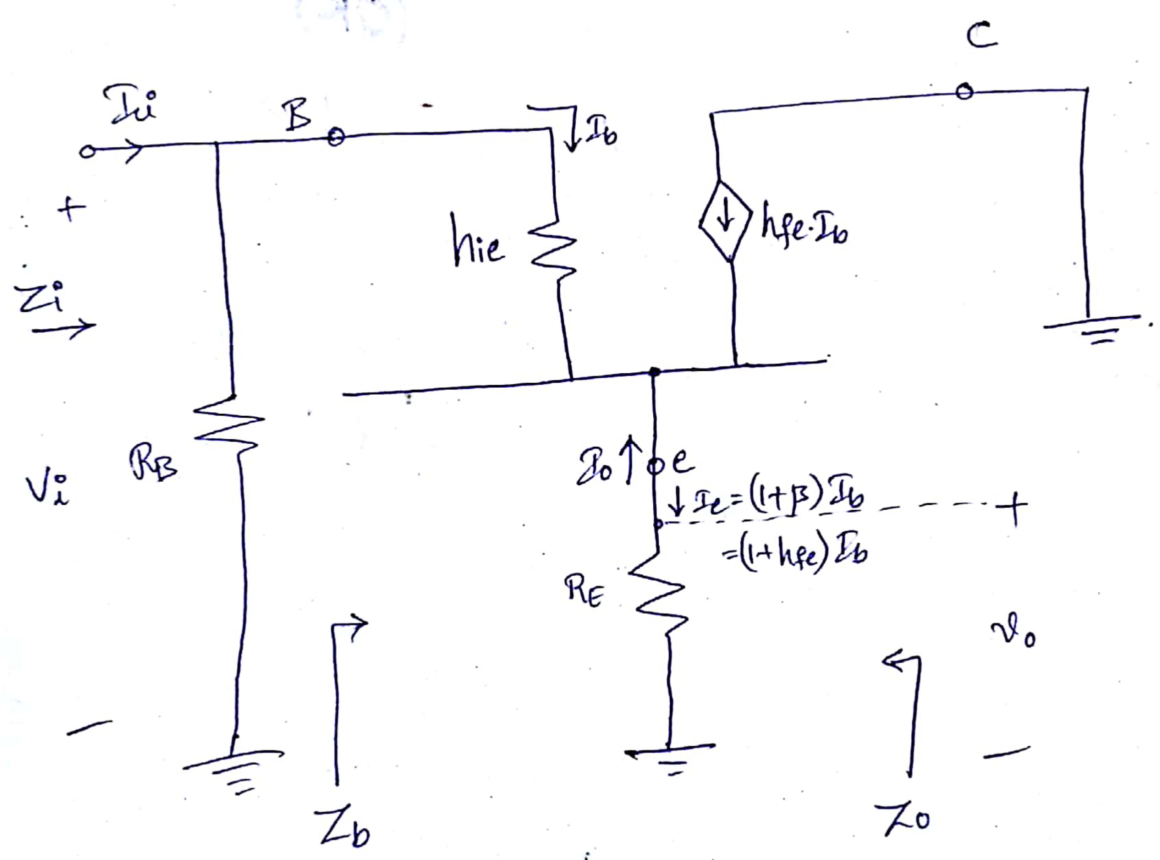
$V_{CC} = 10V$

$R_B = 100K\Omega$

$R_E = 1K\Omega$

$h_{ie} = 1.1K\Omega$

$h_{fe} = 100$



Zi:

$$Z_b \simeq h_{fe} \cdot R_E \quad [\because R_E \gg h_{ie}]$$

$$\simeq 100 \times 1K$$

$$\simeq 100K\Omega$$

$$Z_i = R_B || Z_b = 100K || 100K = 50K\Omega$$

$$\boxed{Z_i = 50K\Omega}$$

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Z_o:

$$Z_o = R_E \parallel \frac{h_{ie}}{1+h_{fe}}$$

$$Z_o \simeq R_E \parallel \frac{h_{ie}}{h_{fe}} \qquad [\because 1+h_{fe} \simeq h_{fe}]$$

$$\simeq 1K \parallel \frac{1.1K\Omega}{100}$$

$$\simeq 1K \parallel 11$$

$$\simeq 10.88\Omega$$

$$\boxed{Z_o \simeq 10.88\Omega}$$

A_V:

$$A_V \simeq \frac{R_E}{R_E + h_{ie}/h_{fe}} \simeq \frac{1K}{1K + 11} \simeq .989$$

$$\boxed{A_V = 0.989}$$

A_i:

$$A_i \simeq -\frac{h_{fe} \cdot R_B}{R_B + Z_b} = -\frac{100 \times 100K\Omega}{100K + 100K} = -50$$

$$\boxed{A_i = -50}$$

(OR)

$$A_i = -A_V \cdot \frac{Z_i}{R_E} = -0.989 \times \frac{50K}{1K} = -49.45$$

Q5 (a) for Complete Ans. Refer page No: 310 Example 5.17

Ans: ED & Circuit theory, Robert L Boylestad, 11th Edition

$\beta_D = 50 \times 100 = 5000$ — ½ M

$I_{B_1} = 3.16 \mu A$ — 1 M

$I_{C_2} \simeq I_{E_2} = \beta_D \cdot I_{B_1} = 15.80 mA$ — 1 M

$V_{C_1} = V_{C_2} = 18 v$

$V_{E_2} = 6.16 v$ — ½ M

$V_{B_1} = 7.56 v$ — 1 M

$V_{CE_2} = 11.84 v$ — 1 M

5 M

Q5 (b) for Complete Ans Refer page No: 814 Example 15.8

Ans: ED & Circuit theory, Robert L Boylestad, 11th Edition.

$V_o = V_Z - V_{BE} = 11.3 v$ (1M)

$V_{CE} = V_i - V_o = 8.7 v$ (1M)

$I_R = 36.4 mA$ (1M)

$I_L = 11.3 mA$ ½ M

(1M) $I_L = I_C \simeq I_E$, $I_B = \frac{I_C}{\beta} = \frac{11.3 mA}{50} = 226 \mu A$

(½M) $I_Z = I_R - I_B = 36.4 mA - 226 \mu A \simeq 36 mA$

5 M