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Semester I

B.Sc.	✓
B.C.A.	
M.Sc.	

Answer Booklet No. 40860

Theory Semester End Examination	April/May 2022
	Nov./Dec. 20

Certified that the entries made by the candidate are found to be correct.

Signature of the Room Supervisor with Date 18/3/22

Exam. Reg. No.		1	2	1	M	E	0	2	2

Class : BSc. I Subject : Electronics Subject Code No. 121DSC01T-I-22.

Paper : III

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121ME022

IMPORTANT INSTRUCTIONS TO CANDIDATES

1) On the cover page of answer book compulsorily mention your Register Number, Subject, Course Code and required information.

2) Don't write your name or mark any signs, such answer scripts shall not be assessed and punished.

3) Write your answer from 1st page and don't leave any blank pages and blank space in between.

4) Last page is meant for rough work and on completion put cross mark (x)

5) The candidates are informed strictly to write their answer only with black ink & write on both sides of the answers sheets.

IMPORTANT INSTRUCTIONS TO CANDIDATES

6) Please mention the Question number in the margin. Answer's without Question number & also with wrong question number shall not be valued.

7) The students are informed to take compulsorily the signature of the room supervisor with date on the answer book.

8) The candidate should be present 20 minutes before the commencement of the examination. After that no students wil be allowed in the examination hall.

9) Use of any electronic gadgets in the examination hall is strictly prohibited.

10) After the last warning bell, no candidate is allowed to leave his/her seat.

11) Indulging in different ways and using different means that lead to malpractice is prohibited.

12) Don't fold the answers sheets & keep the answer sheets clean.

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Question No.

ಉತ್ತರವನ್ನು ಇಲ್ಲಿಂದ ಆರಂಭಿಸಿ
START WRITING ANSWER FROM HERE BELOW

Unit - I

1.

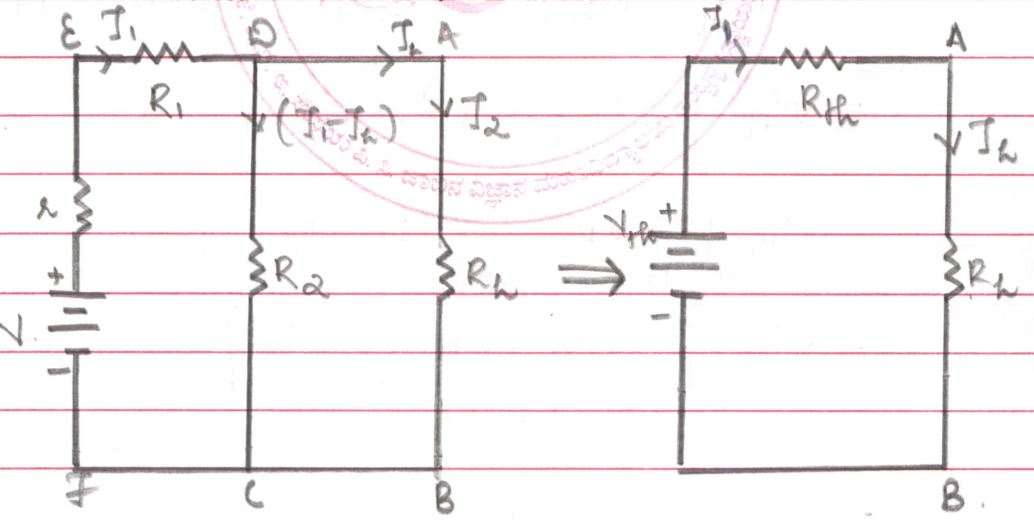
a. **Kirchoff's Current Law :-**

Kirchoff's Current Law states that "The algebraic sum of currents entering is equal equal to the algebraic sum of currents moving away from the junction.

b. **Maximum Power Transfer Theorem :-**

It states that "the load current receives maximum power from a two terminal linear network when it's resistance is equal to thevenin's resistance when all their energy sources are replaced by their internal resistance.

Proof :- Let us consider a network :-



Fig(a)

Fig(b) → Thevenin's eq. circuit.

From fig(b) i.e Thevenin's equivalent circuit.

$$I = \frac{V_{Th}}{R_{Th} + R_L} \quad — (1).$$

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Question No.

Acc. to joules we have power is equal to

$P = I^2 R_L$

$P = \frac{V^2_{Th}}{(R^2_{Th}+R_L)^2} \cdot R_L$ —(2).

Diff equation (2) with respect to R_L and equate it to 0.

$\frac{dP}{dR_L} = \frac{d}{dR_L}\left[\frac{V^2_{Th}}{(R^2_{Th}+R_L)^2} \cdot R_L\right]$

$\frac{dP}{dR_L} = V^2_{Th} \frac{d}{dR_L}\left[\frac{1}{(R_{Th}+R_L)^2} \cdot R_L\right]$

$= V^2_{Th}\left[(R_{Th}+R_L)^{-2} \cdot R_L\right]$

$= V^2_{Th}\left[-2(R_{Th}+R_L)^{-2-1} \cdot R_L + (R_{Th}+R_L)^{-2} 1\right]$

$= V^2_{Th}\left[-2(R_{Th}+R_L)^{-3} \cdot R_L + (R_{Th}+R_L)^{-2}\right.$

$= V^2_{Th}\left[\frac{-2R_L}{(R_{Th}+R_L)^3} + (R_{Th}+R_L)^{-2}\right]$

$= V^2_{Th}\left[\frac{-2R_L + (R_{Th}+R_L)^{-2+3}}{(R_{Th}+R_L)^3}\right]$

$= V^2_{Th}\left[\frac{-2R_L + R_{Th} + R_L}{(R_{Th}+R_L)^3}\right]$

$= V^2_{Th}\left[\frac{-R_L + R_{Th}}{(R_{Th}+R_L)^3}\right]$

$\therefore R_L = R_{Th}$ —(3)

$0 = V^2_{Th}\left[\frac{-R_L + R_{Th}}{(R_{Th}+R_L)^3}\right]$

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Question No.

Sub. eq^n (3) in (2).

$$P = \frac{V^2_{Th}}{(R_L+R_L)^2} R_L$$

$$P = \frac{V^2_{Th}}{(2R_L)^2} R_L$$

$$P = \frac{V^2_{Th}}{4R_L^2} \cdot \cancel{R_L}$$

$$\boxed{P = \frac{V^2_{Th}}{4R_L}}$$

Hence Proved.

c. Norton's Theorem :-

It state's that "In any two terminal linear network containing number of energy sources and impedences it can be replace by a current source (I_N) in parallel with an equivalent resistance (R_N) where I_N is short circuit current current called Norton's current and R_N is equivalent resistance between the same two terminals of a network when all their energy sources are replaced by their internal resistance.

Proof :- Let us consider a network :-

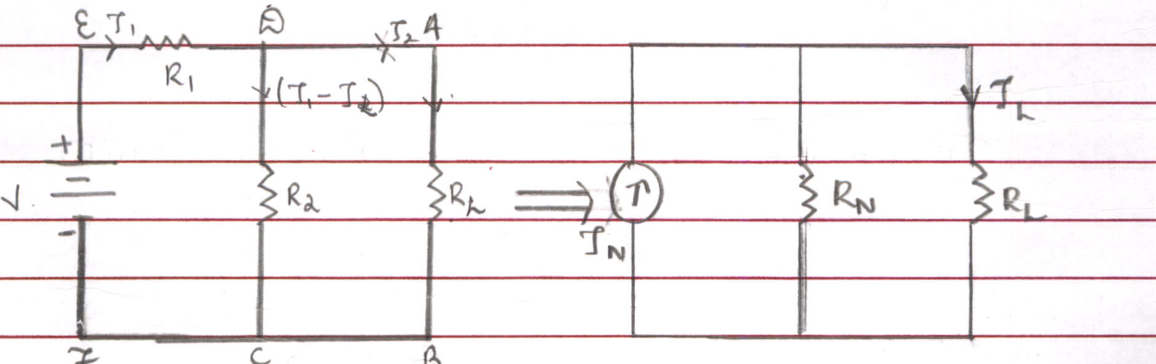

Fig (a)

Fig (b) → Norton's eq. Circuit.

Question No.

Fig (b) i.e Norton's equivalent circuit

$$\boxed{I_L = \frac{I_N R_N}{R_L + R_N}} \quad \text{—(1)}.$$

Apply KVL to the mesh EDCFE.

$$-I_1(r+R_1) - (I_1 - I_L)R_2 + V = 0$$

$$-I_1 r - I_1 R_1 - I_1 R_2 + I_L R_2 + V = 0.$$

$$I_1(r + R_1 + R_2) - I_L R_2 = V \quad \text{—(2)}.$$

Apply KVL to the mesh ABCDA.

$$\cancel{-(I_1 - I_L)R_L} -$$

$$-I_2 R_L - (I_1 - I_L)R_2 = 0$$

$$-I_2 R_L - I_1 R_2 + I_L R_2 = 0.$$

$$I_L(R_2 + R_L) - I_1 R_2 = 0$$

$$I_1 R_2 = I_L(R_L + R_2)$$

$$I_1 = I_L(R_L + R_2) \quad \text{—(3)}$$

Sub eq^n (3) in (2).

$$I_L(R_L + R_2)(r + R_1 + R_2) - I_L R_2 = V.$$

$$I_L = \frac{VR_2}{R_2(r+R_1)} \cdot \frac{1}{\frac{R_L(r+R_1+R_2)}{R_2(r+R_1)} + 1} \quad \text{—(4)}.$$

To calulate I_N remove R_N from the circuit.

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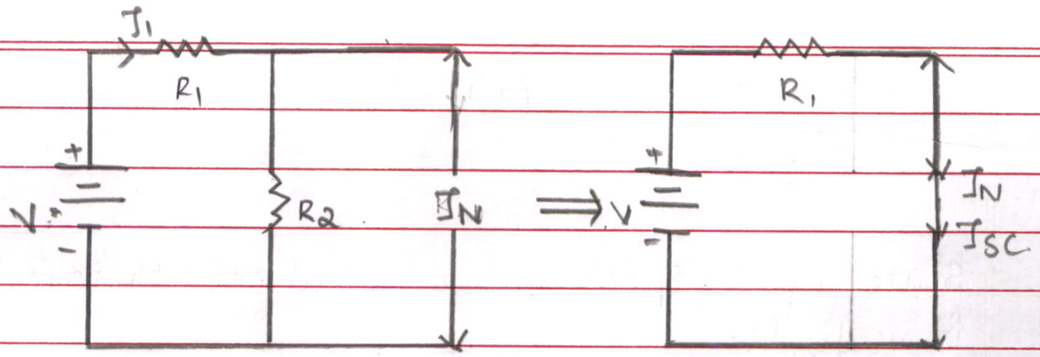
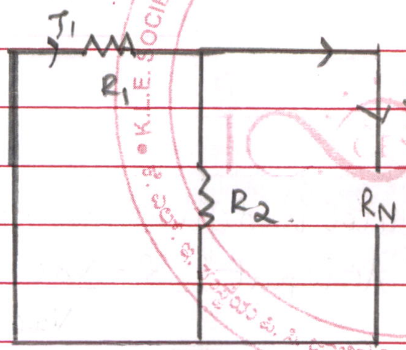
Question No.



$$I_N = \frac{V}{r+R_1} \quad \text{— (5)}$$

To calculate R_N replace energy sources by their internal resistance.



$$R_N = (r+R_1)R_2.$$

$$R_N = \frac{(r+R_1)R_2}{r+R_1+R_2}.$$

$$\frac{1}{R_N} = \frac{r+R_1+R_2}{R_2(r+R_1)} \quad \text{— (6).}$$

Sub eq^n (5) & (6) in (4)

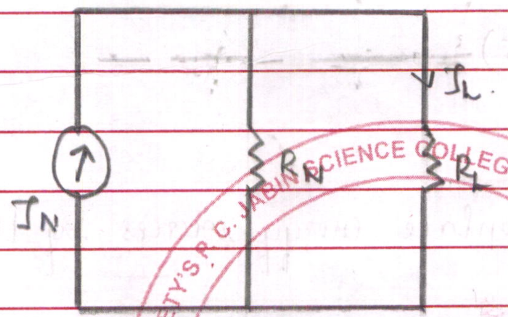
$$I_L = \frac{I_N}{\frac{R_L}{R_N}+1}$$

$$I_L = \frac{I_N}{\frac{R_L+R_N}{R_N}}$$

Question No.

$$\boxed{I_L = \frac{I_N R_N}{R_L + R_N}} \quad — (7)$$

Since eq: (1) & (7) and identical, the Norton's theorem is verified.

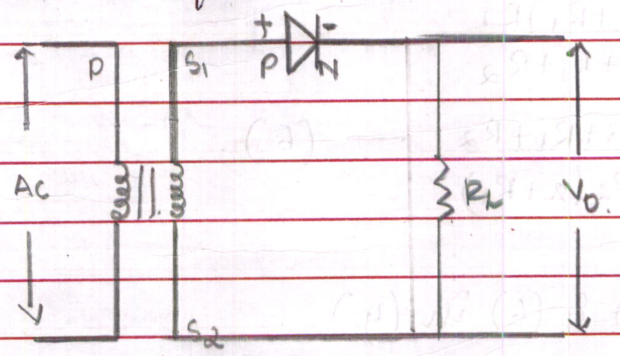


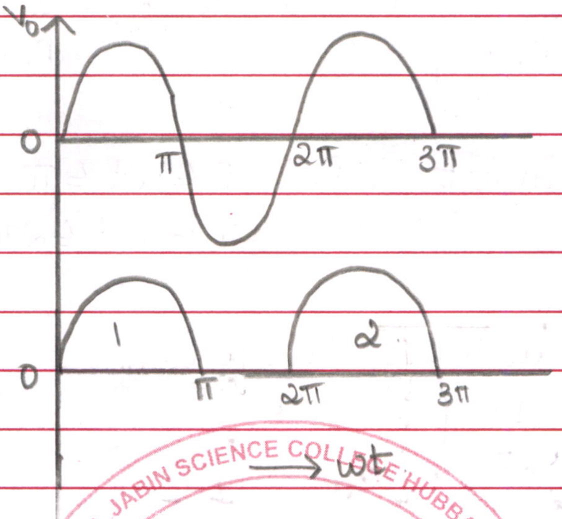
Unit - II

3.

a. Ripple factor :- Ripple factor is defined as the ratio of DC output to that of AC input. $r = \frac{V_{dc}}{V_{ac}}$

b. Half Wave Rectifier :-





The rectifice circuits consists of transformer at the input, it serves two purposes, it steps up or steps down the input voltage, provides isolation for the circuit from the line.

Working:-
A sinasidal ~~for~~ voltage of frequency $\frac{\omega t}{2\pi}$ is applied to the primary of the transformer where $V_i = V_m \sin \omega t$. During the positive half cycle when P is positive with respect to N the diode is said to be in forward biased condition and hence conducts current, the direction is from $P N R_L S_2 S_1 P$.

During the negative half cycle the N is positive is positive with respect to P, the diode does not conduct and is said to be in reverse bias. The wave is in the form of half sine wave seperated by a period of 180°. The pules are sepsented by.

$I = I_m \sin \omega t$.

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Question No.

$$I = \frac{V_m \sin\omega t}{R_L + R_f} \quad \text{where } I_m = \frac{V_m}{R_L + R_f}.$$

$$I = I_m \sin\omega t \quad \text{when } 0 \le \omega t \le \pi$$
$$I = 0 \quad \text{when } \pi \le \omega t \le 2\pi //.$$

c. i. **I_{dc} in Full Wave Rectifier :-**

$$I_{dc} = \frac{1}{2\pi}\int_0^{2\pi} I\, d\theta$$

$$= \frac{1}{2\pi}\left[\int_0^{\pi} I_1\, d\theta + \int_{\pi}^{2\pi} I_2\, d\theta\right]$$

$$= \frac{1}{2\pi}\left[\int_0^{\pi} I_m \sin\theta\, d\theta + \int_{\pi}^{2\pi} (-I_m \sin\theta\, d\theta)\right]$$

$$= \frac{I_m}{2\pi}\left[\int_0^{\pi} \sin\theta\, d\theta + \int_{\pi}^{2\pi} (-\sin\theta .\, d\theta)\right]$$

$$= \frac{I_m}{2\pi}\left[\int_0^{\pi} -\cos\theta + \int_{\pi}^{2\pi} \cos\theta\right]$$

$$= \frac{I_m}{2\pi}\left[[-\cos\theta]_0^{\pi} + [\cos\theta]_{\pi}^{2\pi}\right]$$

$$= \frac{I_m}{2\pi}\left[(-\pi - \theta) + (2\pi - \pi)\right]$$

$$= \frac{I_m}{2\pi}\left[-(-1-1) + (1+1)\right]$$

$$= \frac{I_m}{2\pi}\left[2 + 2\right]$$

$$= \frac{I_m}{\cancel{2}\pi} \cancel{4}\,2$$

$$= \frac{I_m}{\pi} \cdot 2$$

$$\boxed{I_{dc} = \frac{2 I_m}{\pi}}$$

$$I_{dc} = \frac{2}{\pi}\left(\frac{V_m}{R_L + R_f}\right) \qquad \text{Where} \quad I_m = \frac{V_m}{R_L + R_f}.$$

<u>I_{rms} in Full Wave Rectifier</u> :-

ii. $$I_{rms} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} I^2 \, d\theta}$$

$$= \sqrt{\frac{1}{2\pi}\int_0^{2\pi} I_1^2 \, d\theta + \int_\pi^{2\pi} I_2^2 \, d\theta}$$

$$= \sqrt{\frac{1}{2\pi}\int_0^{\pi} I_m^2 \sin^2\theta \, d\theta + \int_\pi^{2\pi} I_m^2 \sin^2\theta \, d\theta}.$$

$$= \sqrt{\frac{I_m^2}{2\pi}\int_0^{\pi} \sin^2\theta \, d\theta + \int_\pi^{2\pi} \sin^2\theta \, d\theta}$$

$$= \sqrt{\frac{I_m^2}{2\pi}\left[\int_0^{\pi}\left(\frac{1-\cos 2\theta}{2}\right) d\theta + \int_\pi^{2\pi}\left(\frac{1-\cos 2\theta}{2}\right) d\theta\right]}$$

$$= \sqrt{\frac{I_m^2}{4\pi}\int_0^{\pi}(1-\cos 2\theta)\, d\theta + \int_\pi^{2\pi}(1-\cos 2\theta)\, d\theta}$$

$$= \sqrt{\frac{I_m^2}{4\pi}\left[\left[\theta\right]_0^{\pi} - \left[\frac{\sin 2\theta}{2}\right]_0^{\pi} + \left[\theta\right]_\pi^{2\pi} - \left[\frac{\sin 2\theta}{2}\right]_\pi^{2\pi}\right]}$$

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Question No.

$$= \sqrt{\frac{I_m^2}{4\pi} (\pi - 0) - (0-0) + (2\pi - \pi) - (0-0)}$$

$$= \sqrt{\frac{2I_m^2}{4\pi} [\pi + \pi]}$$

$$= \sqrt{\frac{I_m^2}{\cancel{4\pi}_{2}} \cancel{2\pi}}$$

$$= \sqrt{\frac{I_m^2}{2}}$$

$$\boxed{I_{rms} = \frac{I_m}{\sqrt{2}}}$$

Unit - III

5

a Stability factor :- The process of maintaince of variable of temperature and the value of β is known as stabilization and the factor used for this process is known as stability factor.

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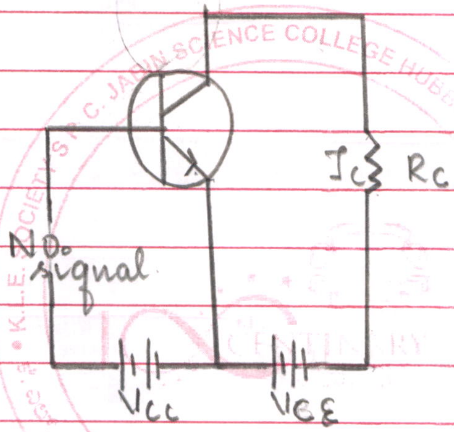
Question No.

b. Construction of dc load line.

To maintain the proper flow of zero signal collector current and collector to emitter voltage we have two methods:-

i Graphical method
ii Load line method.



$V_{CE} = I_C R_C + V_{CE}$ — (1)

Here R_C and V_{CC} are constants and equation one is in the form of standard equation of straight line.

To calculate the dc load line we need 2 points (x, y)

i Sub $I_C = 0$.

$V_{CC} \cong V_{CE}$.

This is the point on x-axis

ii Sub $V_{CE} = 0$.

$0 = I_C R_C + V_{CC}$.

$I_C = \frac{V_{CC}}{R_C}$ — (2)

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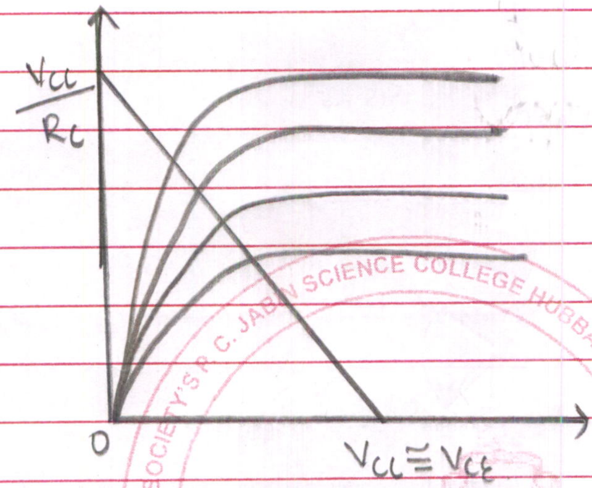
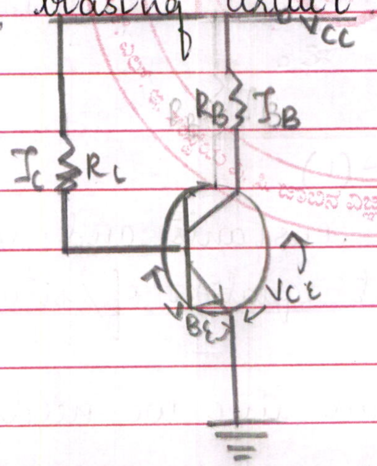
Question No.

This is the point on y-axis.
By joinig these two we get the dc load line.



c. Fixed biasing circuit



In this circuit the value of R_B is kept constant, hence the name fixed biasing circuit.

To calculate the O.P we need to find three steps:-
i Calculate I_B
ii Calculate I_C
iii Calculate V_{CC}.

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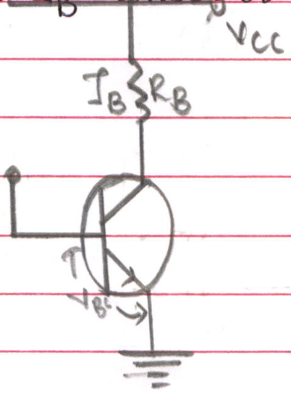
Question No.

i To calculate I_B consider the input circuit :-



Apply KVL to this circuit :-

$$V_{CC} = I_B R_B + V_{BE}.$$

$$I_B R_B = V_{CC} - V_{BE}$$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B}$$

$$I_B = \frac{V_{CC}}{R_B} \quad -(1) \quad [\because V_{BE} \text{ can be neglected}].$$

ii To cal I_C :-

we know that

$$I_C = \beta I_B.$$

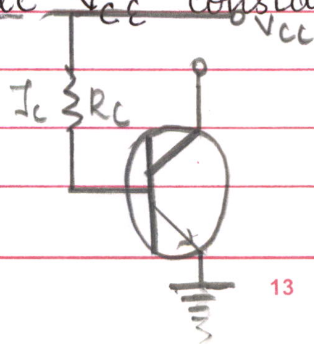
I_{CBO} is the leakage current

$$I_C = \beta I_B + I_{CBO}$$

$\therefore$ leakage current can be neglected

$$I_C = \beta I_B \quad —— (2).$$

iii To calculate V_{CE} consider the output circuit.



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Question No.

$V_{CC} = V_{CE} - I_C R_C$

$V_{CE} = V_{CC} + I_C R_C$ — (3).

∴ The equation (2) and (3) give us the operating point.

Unit - IV.

8.

a. **Binary to Decimal Conversion:**

i $(1101.11)_2$

$= 1\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0 + 1\times2^{-1} + 1\times2^{-2}$

$= 8 + 4 + 0 + 1 + 1\times\frac{1}{2} + 1\times\frac{1}{4}$

$= 8 + 4 + 0 + 1 + 1\times0.5 + 1\times0.25$

$= 8 + 4 + 0 + 1 + 0.5 + 0.25$

$= (13.75)_{10}$.

ii $(1111.01)_2$

$= 1\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0 + 0\times2^{-1} + 1\times2^{-2}$

$= 8 + 4 + 2 + 1 + 0 + 1\times\frac{1}{4}$

$= 8 + 4 + 2 + 1 + 0 + 1\times0.25$

$= 8 + 4 + 2 + 1 + 0 + 0.25$

$= (15.25)_{10}$.

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Question No.

b. 2's complement subtraction method :-

i Write minuend as it is.

ii Perform 2's complement of the subtrahend.

iii Add subtrahend to minuend.

iv If there is carry, drop the carry and write the answer as it is.

v. If no carry, then 2's recomplement the answer and attach minus sign to it :-

Eg:- i $(101)_2$ from $(111)_2$

```
111              ~~111~~          101 → 010
101  ~~→~~       ~~101~~               +   1
                                      -------
                                      011

 111
+011
-----
1010
```

↓ If carry → Drop the carry.

$(010)_2$ //.

ii $(111)_2$ from $(101)_2$.

```
101              111 → 000
111                   +   1
                      -----
                       001

 101
+001             110 → 001
-----                  + 11
 110                   -----
No carry                010
```

So, 2's recomplement the answer and attach minus sign to it.

→ $-(010)_2$ //.

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Question No.

c. **Conversion of Binary to Gray :-**

In a four bit binary conversion to gray conversion:

i The gray bit will remain the same as that of the binary bit.

ii The 2nd bit will be the successive addition

iii Carry the successive addition till the LSB of the 4 bit code.

iv The answer will be 0 if both are similar and the answer will be 1 if they are different.

Eg:- $(1\ 0\ 0\ 0)_2$

B.- 1 + 0 + 0 + 0.

↓ ↓ ↓ ↓

G- 1 1 0 0.

$(1000)_2 \longrightarrow (1100)_G.$

Conversion of Gray to Binary :-

In a four bit gray to binary conversion:-

i The binary bit i.e MSB will remain the same as that of the gray bit.

ii The 2nd bit will be the addition of the binary bit and the 2nd bit of the gray

iii Continue the addition till the LSB of the bit.

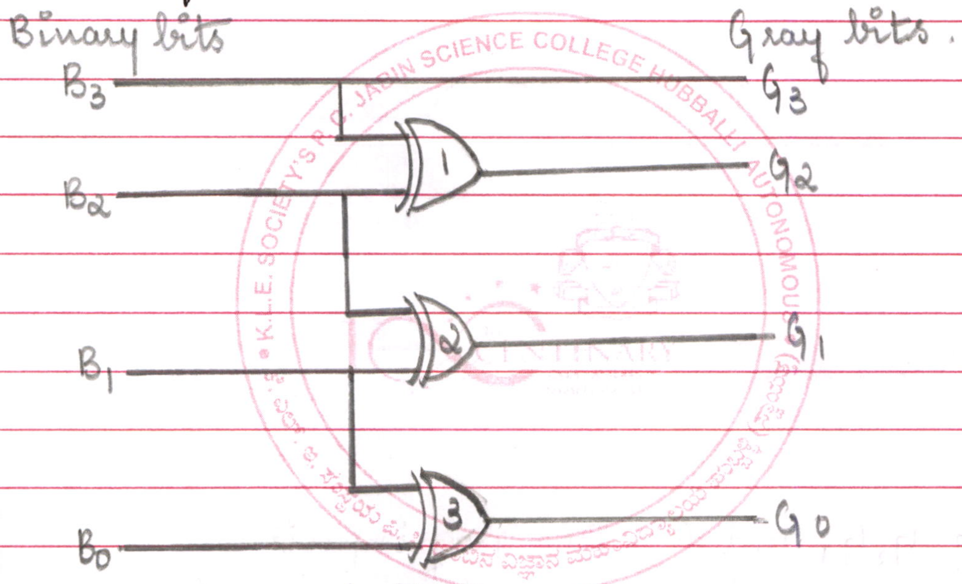
Eg:- $(1\ 1\ 1\ 1)_G$

G → 1 1 1 1

B → 1 0 1 0.

$(1111)_G \rightarrow (1010)_2$.

<u>Binary to Gray</u>:-



IC = 7486.

B_2 B_1 B_1 and B_0 are binary inputs.
G_3 G_2 G_1 and G_0 are gray outputs.

$B_3 = G_3$
$B_2 = G_3 \oplus G_2$
$B_1 = G_2 \oplus G_1$
$B_0 = G_1 \oplus G_0$.

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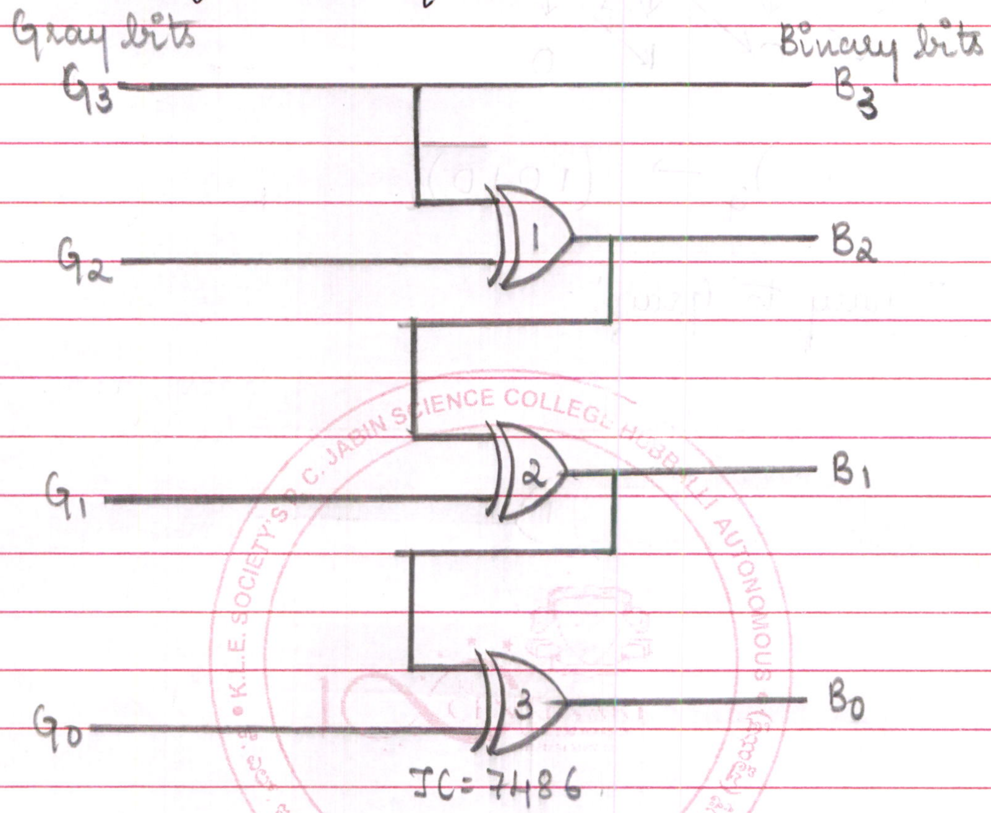
Question No.

Gray to Binary Conversion :-



G_3 G_2 G_1 and G_0 are gray inputs
B_3 B_2 B_1 and B_0 are binary outputs.

$G_3 = B_3$.
G

ಪ್ರಶ್ನೆ ಸಂಖ್ಯೆ
Question No.

ಪ್ರಶ್ನೆ ಸಂಖ್ಯೆ
Question No.

ಪ್ರಶ್ನೆ ಸಂಖ್ಯೆ
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