PUX-32

GOVERNMENT OF KARNATAKA

KARNATAKA STATE PRE-UNIVERSITY EDUCATION EXAMINATION BOARD

II YEAR P.U.C. EXAMINATION OF

MARCH 2013

MAIN ANSWER BOOK

Please read the instructions overleaf before filling in

Answer Book Sl. No.
1946835

Register No. of the Candidate					
3	8	3	4	6	7

Subject Code : 40 Subject : Electronics

Sl. No. of Additional answer sheets used		No. of pages used in		Total No. of Pages used
		Main Answer book	Addnl. answer book/s	
1.	5314228	14	6	20
2.	5317783			
3.				
4.				
5.				
6.				
7.				
8.				

Certified that the entries made above by the Candidate are found to be correct

14/3/13

Signature of the Invigilator with date

FOR THE USE OF EXAMINERS ONLY

Marks awarded

Part	1	2	3	4	5	6	7	8	9	10	Total Marks
	1	1	1	1	1	1	1	1	1	1	10
	11	12	13	14	15	16	17	18	19	20	
	2	2	2	2	2	2	2	0	2	2	16
	21	22	23	24	25	26	27	28	29	30	
	2	2	4	4	4	4	4	4	0	0	28
	31	32	33	34	35	36	37	38	39	40	
	4	6	6	6	6	0	0	6	5	6	36
	41	42	43	44	45	46	47	48	49	50	
	51	52	53	54	55	56	57	58	59	60	
	61	62	63	64	65	66	67	68	69	70	
	71	72	73	74	75	76	77	78	79	80	

Grand Total in Words	Ninty only	Grand Total in Figures	90

Signature of the Dy. Chief Examiner with date

Code No. of D.C.E. 3007

Signature of the Reviewer with date

Code No. 3009

Signature of the Assistant Examiner with date

07/09/13

Code No. of A.E. 3011

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INSTRUCTIONS TO CANDIDATES

1. Write your register number Correctly on the space provided on the Facing Sheet of the Answer book and the top left side of Additional answer sheets. Over writing should be attested by the Room Invigilator.
2. Write answers in both sides of the sheet using BLUE/BLACK ink or ball point pen.
3. Obtain Additional Sheets, Graph Sheets, Mathematical table from the Invigilator if required. Enter the serial numbers of all the Additional sheets used.
4. Intimate disorders if any, in the Main Answer book/ Additional sheets to the invigilator.
5. Indicate the Correct question number in the margin.
6. Obtain the permission of the Invigilator for change of PEN / INK.
7. All rough work should be made on a particular page with the heading ROUGH WORK and cross it.
8. Do not write in the margin and leave any page UNUSED except at the end of answers.
9. No Candidate is permitted to leave the examination hall within 30 minutes from the commencement of the examination. Any candidate who leaves after 30 minutes will not be allowed again to the examination hall.
10. If you want to make any request to the Room Invigilator, just stand up to attract his / her attention. Do not shout or leave your place. The invigilator will come to you.
11. During the examination if the candidate wants to go out, for urination etc., same may be informed to the invigilator. While going out, the Answer paper, Question paper etc., should be handed over to the Room Invigilator for safe custody.
12. After completion, just stand up & inform the same to the Room Invigilator who in turn will collect the papers and gets your signature on the diary maintained by the Invigilator.
13. The following misdeeds will attract disciplinary actions and criminal prosecution.
    a) Breach of silence.
    b) Use of books, notes, manuscripts, etc., pertaining to the subject in the examination hall.
    c) Talking or signalling to other Candidates.
    d) Candidates copying from the answer books of the other candidates or from other source.
    e) Sending of answer books or additional sheets or question paper out of the examination hall.
    f) Impersonation.
    g) Taking the answer books or additional sheets received for writing the answers out of the examination hall during or after the examination.
    h) Tearing or insertion to the answer books and the additional sheets.
    i) Writing an appeal or request to the valuator in the answer book.
    j) Mobile Phones, Pagers are strictly prohibited in the Examination Hall.
    k) Simple calculators can be used. Scientific calculators allowed only for Statistics paper.
14. After completion of writing, Count the No. of pages used and fill the columns provided on the facing sheet of the main answer book.
15. Candidates suffering from infectious diseases are not allowed to sit in the examination hall.

Part A.

1. Arrow mark indicates conventional direction of current through transistor.

2. CC amplifier

3. Distortion decreases

4. Output voltage is zero.

5. RC oscillators

6. It is the distance between last ground wave reception to first sky wave reception.

7. $m_a = \frac{V_{max} - V_{min}}{V_{max} + V_{min}}$

8. Output is ~~zero~~ '1' [Output is one]

9. 0101 0011 0100 in excess-3

10. It is a ~~st~~ system that records and retrieves audio signals and plays announcement to callers.

Part - B

11 $\alpha = 0.98$, $I_c = 5mA$

$$\beta = \frac{\alpha}{1-\alpha}$$

$$= \frac{0.98}{1-0.98}$$

$$= 49$$

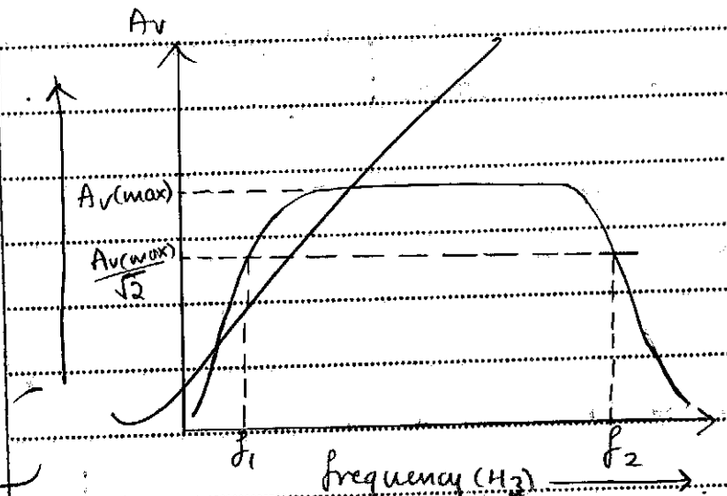
$$\beta = \frac{I_c}{I_B}$$

$$I_B = \frac{I_c}{\beta}$$

$$= \frac{5 \times 10^{-3}}{49}$$

$$= 102.041 \mu A$$

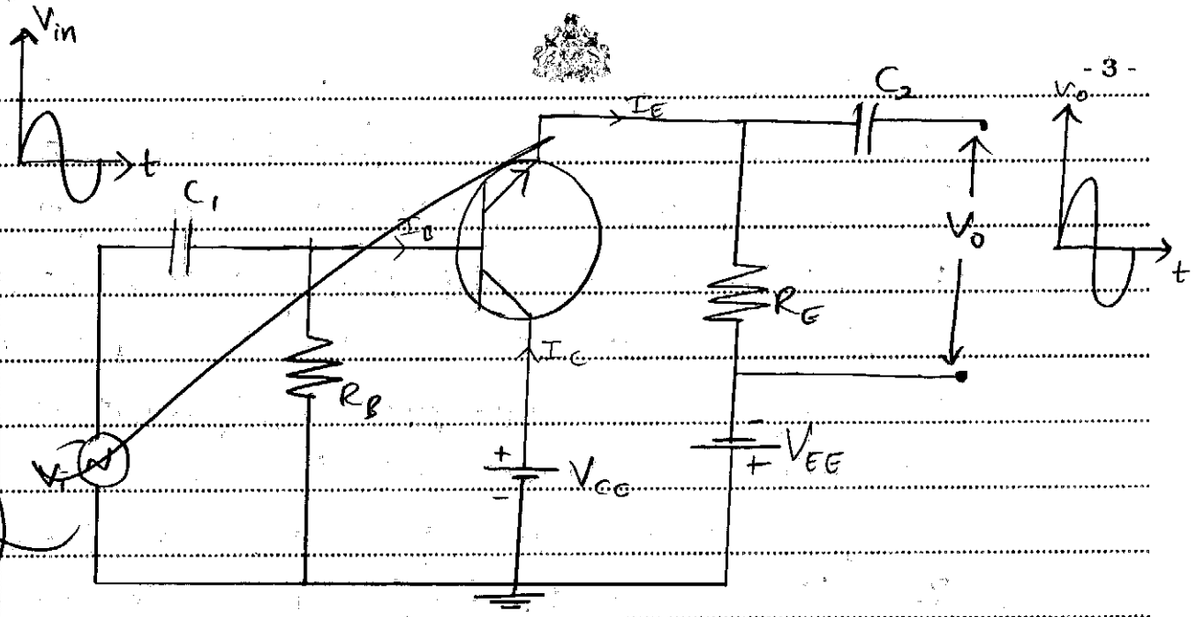
12



Bandwidth = $(f_2 - f_1)$ Hz

04

13



14

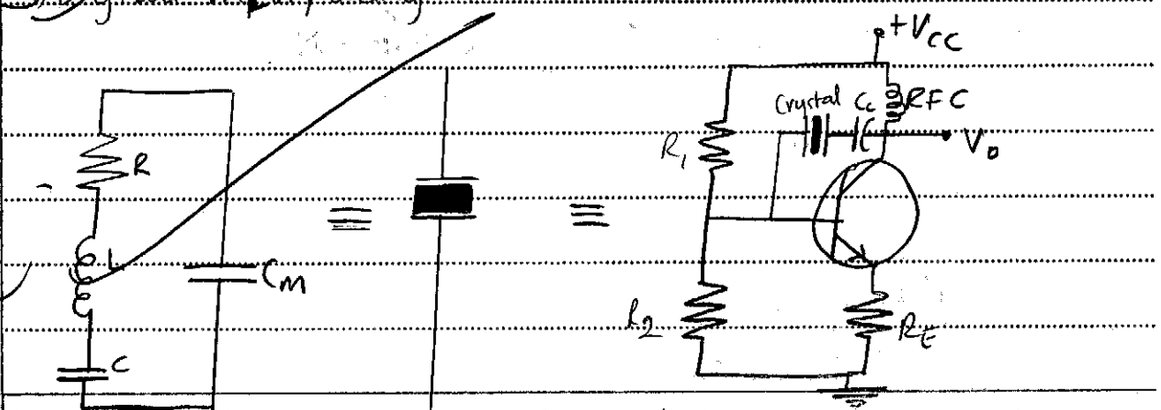
Positive feedback	Negative feedback
1) Feedback signal is in phase with input signal.	1) Feedback signal is out of phase with input signal
2) Gain increases with positive feedback	2) Gain decreases with negative feedback
3) Also called regenerative feedback	3) Also called degenerative feedback

15 Applications of comparator →

1) Schmitt Trigger

2) Digital Interfacing

16



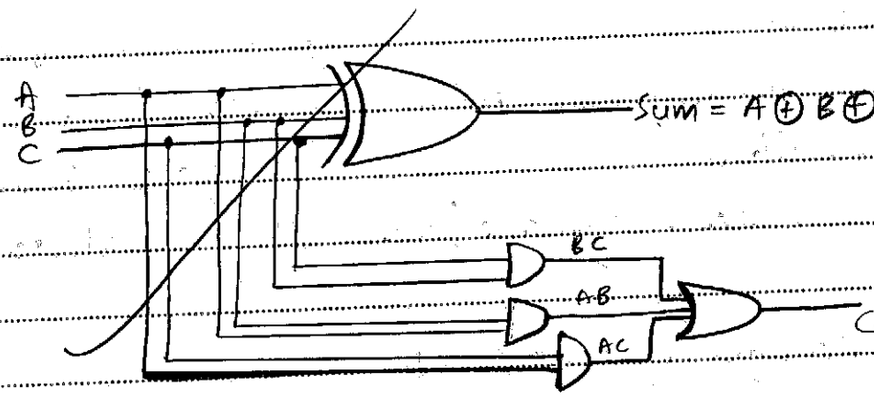
08 ಪೈ ಮುಖದ ಬಿಟ್ಟ ಅಂಶಗಳು Circuit symbol and equivalent circuit of crystal. ಎರಡನೇ ಪಿಯುಸಿ ಪರೀಕ್ಷೆ-ಮಾರ್ಚ್ 2013

17 Sky waves are transmitted from Earth ~~and~~ directly from transmitter and wave returns back getting reflected by ionospheric layers of Earth. Amount of reflection or refraction of transmitted wave depends on density of ionosphere layer, frequency of wave and angle at which it is incident on that layer.

Space waves consists of 2 components TR and TER. TR is transmitted directly from transmitter to receiver. TER component travels along the Earth. It requires good line of sight conditions.

2

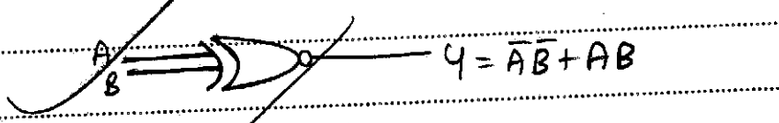
20



FULL ADDER

2

21 Truth table is of XNOR gate.



2

22 1) Frequency reuse

2) Cell splitting

2

06

Part-C

I 23 V_i = 0-5 V

Sl.No.	R_i (KΩ)	R_f (KΩ)	V_o (volt)	Voltage gain. Theoretical $A_V = 1 + \frac{R_f}{R_i}$	Voltage gain. Practical $A_V = \frac{V_o}{V_i}$
1	2·2	8·2	2·36	4·727	4·72
2	1·2	5·6	2·83	5·666	5·66

Calculation:-

Experimental:- 1) $A_V = \frac{V_o}{V_i} = \frac{2·36}{0·5} = 4·72$

2) $A_V = \frac{V_o}{V_i} = \frac{2·83}{0·5} = 5·66$

Theoretical:- 1) $A_V = 1 + \frac{R_f}{R_i} = 1 + \frac{8·2 \times 10^3}{2·2 \times 10^3} = 3·727 + 1$

$= 4·727$

2) $A_V = 1 + \frac{R_f}{R_1} = 1 + \frac{5·6 \times 10^3}{1·2 \times 10^3} = 5·666$

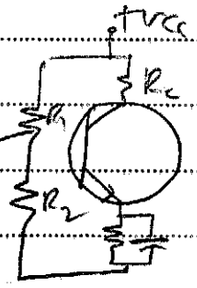
II 24

$V_B = \frac{V_{CC} R_2}{R_1 + R_2}$

$= \frac{18 \times 12 \times 10^3}{(47+12) \times 10^3}$

$= 3·661$ V

$I_E = \frac{V_B - V_{BE}}{R_E} = \frac{3·66 - 0.7}{1 \times 10^3} = 2·961$ mA



$$r_e = \frac{52 \times 10^{-3}\ V}{2.961 \times 10^{-3}\ A} \qquad \left[\because r_e = \frac{50\,mV}{I_E}\right]$$

$$= 17.561\ \Omega$$

Input base resistance $= R_{in(base)} = \beta r_e$

$$= 100 \times 17.561$$

$$= 1.756\ k\Omega$$

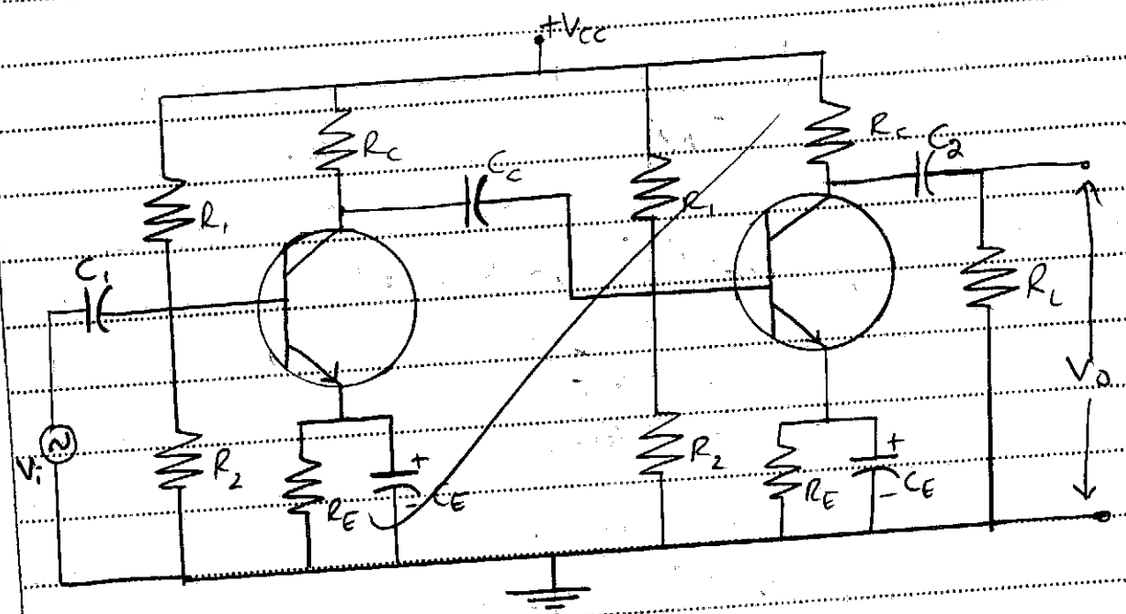
Voltage gain $= A_V = \frac{r_o}{r_e} = \frac{R_C \| R_L}{r_e} = 141.29$

$$R_C \| R_L = \frac{R_C R_L}{R_C + R_L} = \frac{3.3 \times 10^3 \times 10 \times 10^3}{13.3 \times 10^3} = 2.481\ k\Omega$$

$$A_V = \frac{r_o}{r_e} = \frac{2.481}{17.561} = 0.141 \times 10^3$$

$$= 141.29$$

125



RC - coupled amplifier.

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Advantages:- 1) Wide frequency response
2) Low frequency distortion
3) Uses cheap components like resistors and capacitor and overall amplification is more than other amplifiers.

4

26 $A_V = 150$, $BW_1 = 200KH_3$, $\beta = 0.04$

Gain with negative feedback = $A_{Vf} = \frac{A_V}{1+A_V\beta}$

$= \frac{150}{1+150\times 0.04}$

$= 21.428$

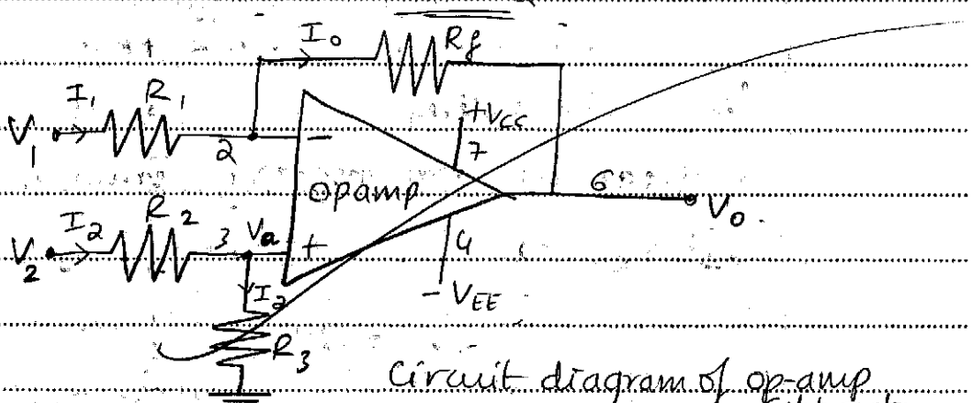
$A_V BW_1 = A_{Vf} BW_2$

$BW_2 = \frac{150\times 200\times 10^3}{21.428}$ $\quad BW_2 = BW_1(1+A_V\beta)$

$= 1.4MH_3$

4

27



Circuit diagram of op-amp subtractor.

V_1 be the input voltage applied to inverting terminal of opamp through resistor R_1 and V_2 be the input voltage applied to op-amp through voltage divider circuit consisting of resistor R_2 and R_3 and it is applied to non-inverting terminal

08

R_f is the feedback resistor which feedbacks portion of output voltage as input to op-amp.

To find the output voltage of op-amp subtractor we have to apply superposition theorem

$$V_o = V_{o_1} + V_{o_2}$$

V_{o_1} be the output voltage of op-amp with V_1 acting alone and V_2 reduced to zero. Hence the circuit acts as inverting amplifier.

$$V_{o_1} = \left(\frac{-R_f}{R_1}\right)V_1 \quad \text{--- (1)}$$

let V_{o_2} be the output voltage of op-amp with V_2 acting alone and V_1 reduced to zero. Hence the circuit acts as non-inverting amplifier.

$$V_{o_2} = \left(1 + \frac{R_f}{R_1}\right)V_a$$

$$= \left(1 + \frac{R_f}{R_1}\right)\left(\frac{V_2 R_3}{R_2 + R_3}\right) \quad \text{--- (2)}$$

V_a is the voltage across R_3, which is actual input voltage at non-inverting terminal.

(1) + (2) $\Rightarrow$ $V_o = V_{o_1} + V_{o_2}$

$$V_o = \left(1 + \frac{R_f}{R_1}\right)\left(\frac{V_2 R_3}{R_2 + R_3}\right) - \frac{R_f}{R_1}V_1$$

If $R_1 = R_2$ & $R_3 = R_f$

$$V_o = \frac{V_2 R_f}{R_1} - \frac{R_f}{R_1}V_1$$

$$\boxed{V_o = \frac{R_f}{R_1}(V_2 - V_1)}$$

(i) If $R_f = R_1$

$V_o = V_2 - V_1$

∴ Output of opamp subtractor is equal to difference between two input voltages

28 $f_o = 15 \times 10^3 H_3$, $C = 0.01 \mu F$, $L_1 = 1 \times 10^{-3} H$.

$$f_o = \frac{1}{2\pi\sqrt{LC}}$$

$$L = \left(\frac{1}{4\pi^2 f^2}\right)\left(\frac{1}{C}\right)$$

$$= \frac{1}{4 \times (3.142)^2 \times (15 \times 10^3)^2 \times (0.01 \times 10^{-6})}$$

$$= 11.254 \text{ mH}$$

$L = L_1 + L_2$

$L_2 = L - L_1$

$= (11.254 - 1) \times 10^{-3} H$

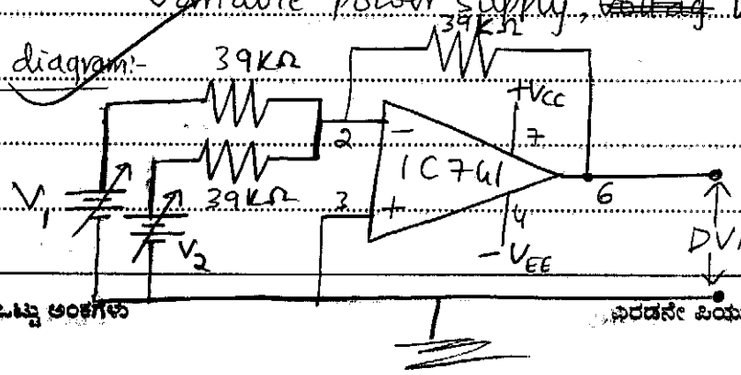
$= 10.254 \text{ mH}$

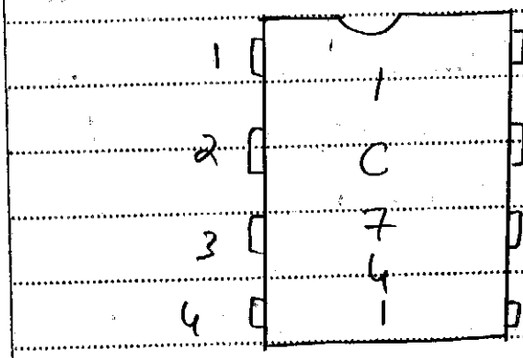
Part-D

I 32 Aim:- To study the working of op-amp adder.

Components:- IC741, resistor, dual power supply, variable power supply, Voltmeter (DVM)

Circuit diagram:-





Pin configuration of op-amp

1 and 5 → offset null

2 → Inverting input

3 → non-inverting input

4 → $-V_{EE}$

6 → Output

7 → $+V_{CC}$ 8 → NC

Theory:- An operational amplifier is called so because it can perform mathematical operations like addition, subtraction and so on.

In op-amp adder circuit V_1 input voltage is applied through R_1 and V_2 is applied through R_2 to the inverting terminal of op-amp. The non inverting is connected to ground. Terminal 4 is connected to negative power supply $-V_{EE}$ and terminal 7 is connected to positive power supply $+V_{CC}$. Circuit is made as shown in figure.

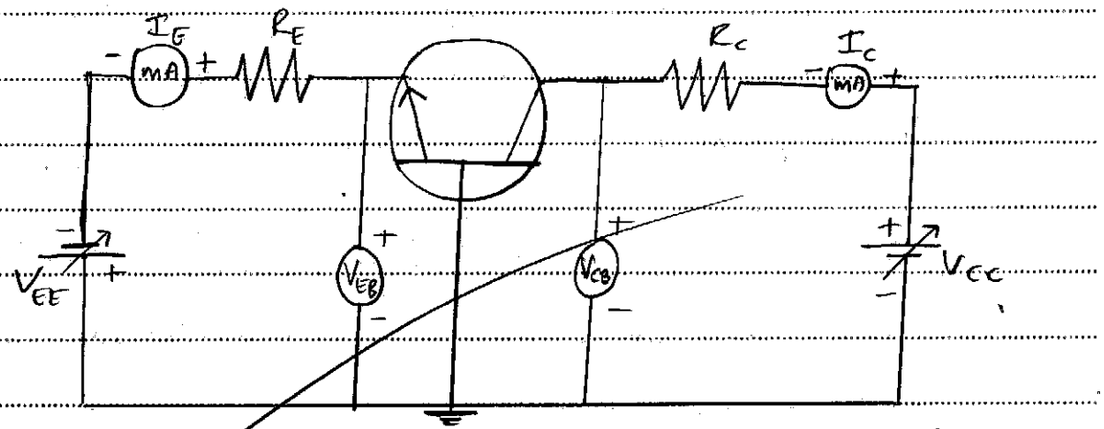
Procedure:- Input voltage V_1 is set to 4V and V_2 is set to 2V and corresponding output voltage is noted. Experiment is repeated for different input combinations and corresponding output is noted. The practical values of output voltage is compared with theortical values for all the input combinations.

Observations:-

Trial No.	V_1 (volt)	V_2 (volt)	Output voltage	
			Practical V_0 (volt)	Theoretical $V_0 = (V_1 + V_2)$ volt
1	4	2		
2	4	-2		
3	-4	2		
4	-4	-2		

Inference :- Theoretical and practical values of output voltage are found to match with each other.

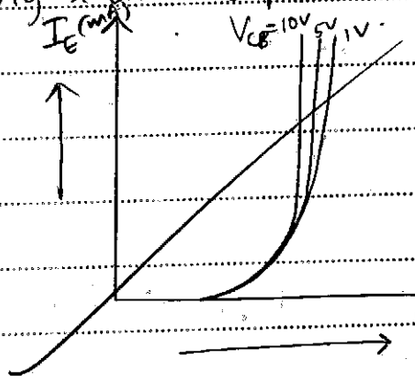
II 33



Circuit diagram shows the transistor in CB configuration. Battery V_{EE} forward biases emitter-base junction and battery V_{CC} reverse biases collector base junction. R_E & R_C and are emitter & collector resistors. V_{EB} and V_{CB} can be measured by voltmeters and I_E and I_C is measured through milliammeters.

Input characteristics :- Input characteristics is a plot of emitter current versus emitter to base voltage for a given value of collector to base voltage. By varying V_{CC}, V_{CB} is set to certain value. Now battery V_{EE} is varied

to set V_{EB} to particular value and corresponding I_E is noted. A graph of I_E along y axis and V_{EB} along x axis is plotted at constant V_{CB}.



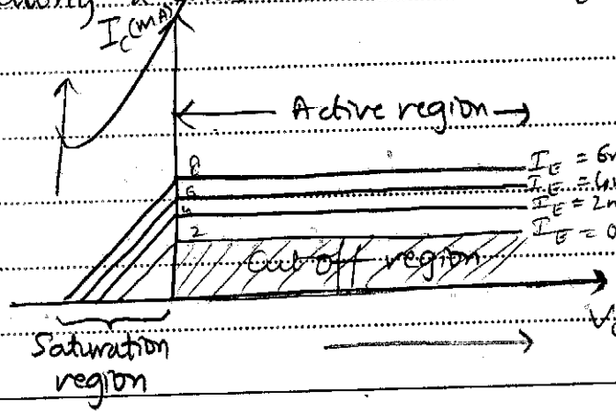
Input resistance = $\frac{\Delta V_{EB}}{\Delta I_E}$ at constant V_{CB}

The graph shows that 1) there exist an offset cut in voltage above which current increase rapidly

2) Input resistance is small.

Output characteristics :- It is a plot of collector current versus collector to base voltage for the given value of emitter current.

By varying V_{EE}, I_E is set to definite value. Now V_{CC} is so varied and V_{CB} is set to particular value and corresponding I_C is noted. A graph of I_C along y axis and V_{CB} along x axis at constant I_E is plotted.



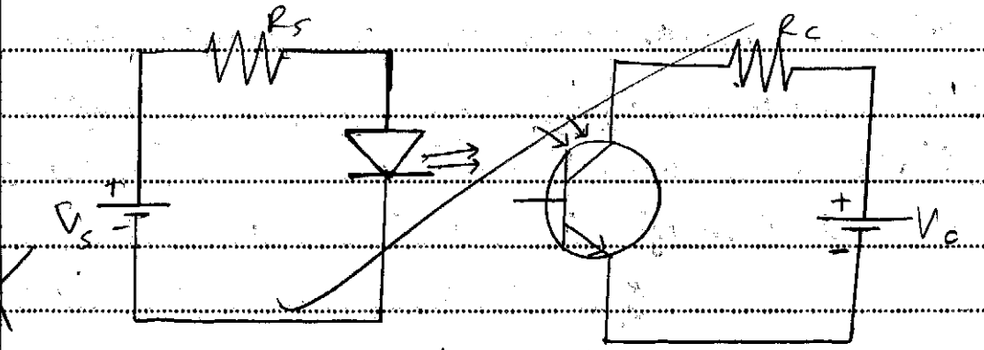
Output resistance = $\frac{\Delta V_{CB}}{\Delta I_C}$ at constant I_E

The graph shows that 1) Even when $I_B = 0$, I_C exists due to reverse saturation current. (cut-off region).

2) $V_{CB} = 0$ even then I_C exists. In saturation region I_C is dependent of I_E.

3) In Active region I_C is independent of V_{CB} & depends only on I_E

34 a) Current in reverse biased npn transistor (photo transistor) due to thermally generated charge carriers when there is no incident radiation is called as dark current.



opto coupler.

Application → 1) It is used in TV remotes

2) In lifts

b $$A_V \text{ in dB} = 20 \log \frac{V_o}{V_i}$$

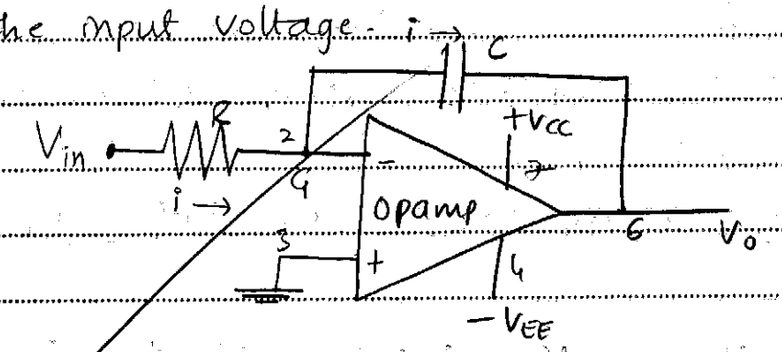
$$\frac{60}{20} = \log \frac{V_o}{40 \times 10^{-3}}$$

$$\text{antilog}(3) = \frac{V_o}{40 \times 10^{-3}}$$

$$V_o = 10^3 \times 40 \times 10^{-3}$$

$$= 40 \text{ V}$$

35 a) Integrator is device whose output voltage is integral of the input voltage.



Let the input voltage to integrator be applied to inverting terminal through resistor R. Let the capacitor be connected between inverting terminal and output terminal of opamp. Let non inverting terminal of opamp be grounded. Node G is virtual ground. Due to infinite input impedance, current through R and C are same.

$$Q = C(V_G - V_o) \qquad V_G = 0V.$$

$$Q = -CV_o \quad — (1)$$

But $Q = \int i\,dt$

$$= \int \left(\frac{V_{in} - V_G}{R}\right) dt = \int \frac{V_{in}}{R}\,dt \quad — (2)$$

Substituting (2) in (1)

$$\frac{1}{R}\int V_{in}\,dt = -CV_o$$

$$\boxed{V_o = -\frac{1}{RC}\int V_{in}\,dt}$$

The integrator functions properly if RC is equal or greater than T (time constant). Hence output voltage is integral of input voltage.

04

GOVERNMENT OF KARNATAKA
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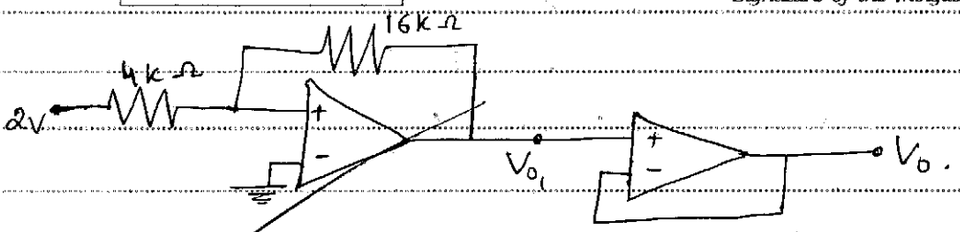
II YEAR P.U.C. EXAMINATION - MARCH - 2013
ADDITIONAL ANSWER SHEET

Answer Sheet No. 5314228 Reg. No. 3 8 3 4 6 7

Main Answer Book Sl. No. 1946835

Signature of the Invigilator with date

b



$$V_{o_1} = \left(1 + \frac{R_f}{R_1}\right) V_{in}$$

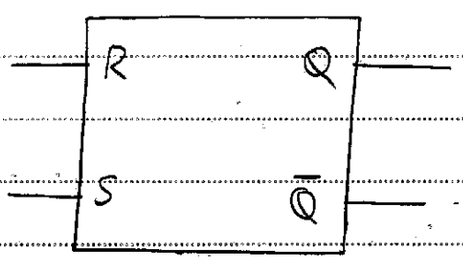
$$= \left(1 + \frac{16 \times 10^3}{4 \times 10^3}\right) 2$$

$$= 10V$$

$V_o = V_{o_1} = 10V$ [∵ Buffer amplifier]

2 good

39 a)



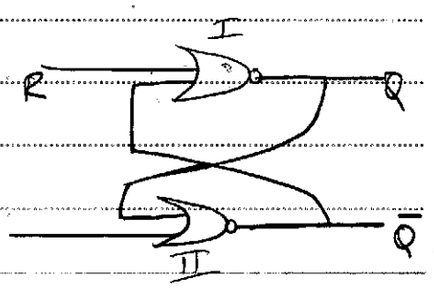
Block diagram of RS flip flop

R	S	Q	$\bar{Q}$
0	0	NC	NC
0	1	1	0 (set)
1	0	0	1 (reset)
1	1	Indeterminate condition	

Truth table of RS flip flop

~~Case (i): R = 0, S = 0~~

RS flip flop can be analysed by using the given diagram. The output of NOR gate is low when any of it's input is high.



02

Case-(i) :- R = 0, S = 1, The II ~~nand~~ nor gate produces zero output as S = 1. Hence $\bar{Q} = 0$. Inputs to I nor gate is 0 and 0 to produce high output Q = 1. This condition is known as set condition.

Case ii) R = 1, S = 0, Output of I nor gate is zero Q = 0. Due to low inputs at II nor gate $\bar{Q} = 1$. This condition is known as reset condition.

Case iii) R = 0, S = 0 Let Q = 0, $\bar{Q} = 1$

Input to I nor gate is 0 & 1 to produce low output Hence II nor gate due to inputs 0 and 0 produces high output i.e Q = 0, $\bar{Q} = 1$

Hence there is no change in output.

Case iv) :- R = 0, S = 0 Let Q = 1, $\bar{Q} = 0$.

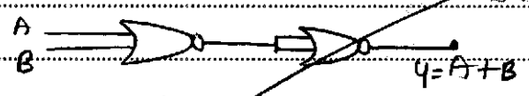
Input of II nor gate is 0 and 1 to produce low output Inputs of I nor gate is 0 and 0 and hence output is high. i.e Q = 1, $\bar{Q} = 0$.

Hence output remains same.

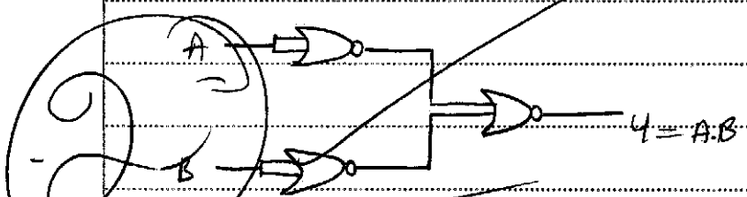
When both R = 1 and S = 1 both gates produce low output Hence this input to RS flip flop must be avoided as the output condition is indeterminate.

RS flip flop ~~produces high output~~ is in set condition when S = 1 and R = 0, It is in reset condition when S = 0 and R = 1 RS flip flop output remains unchanged when both inputs are zero.

b



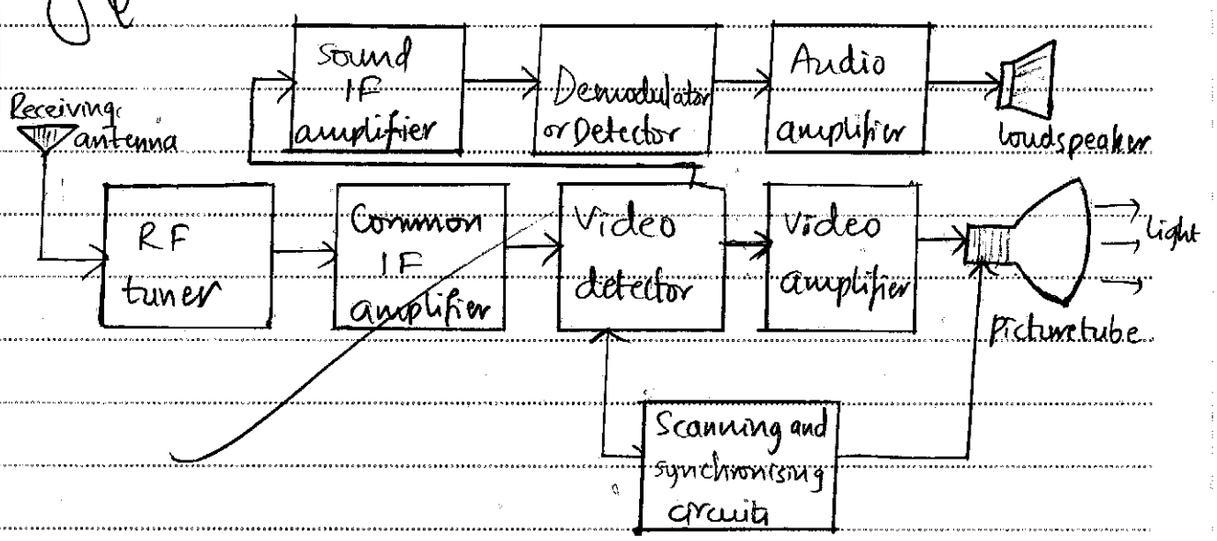
OR gate.



AND gate.

4

40 a.

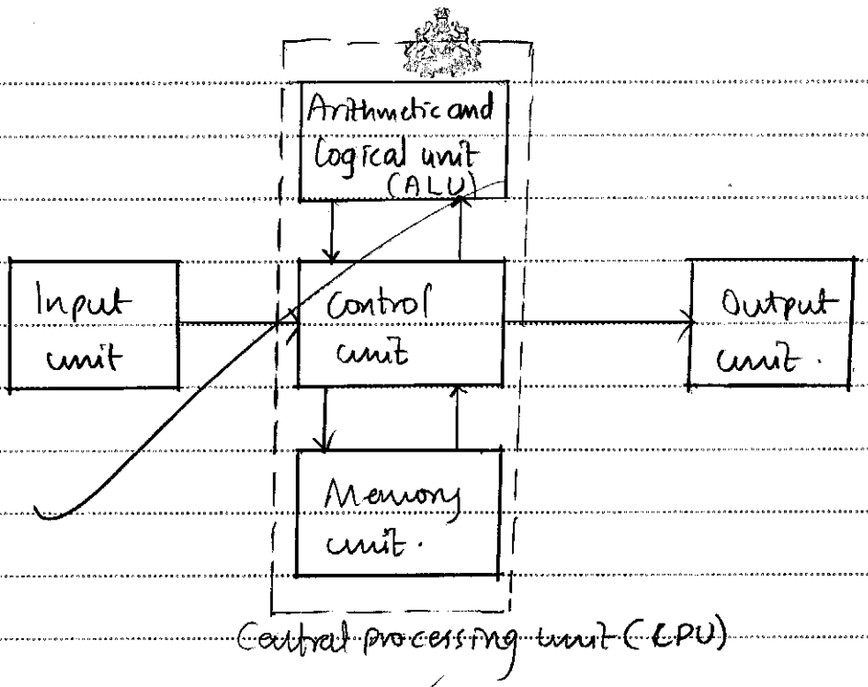


Block diagram of monochrome TV receiver.

b Uplink signal → Signal sent from ~~Beeeb~~ Earth to sattlite is called uplink signal.

2 Downlink signal → signal sent from satellite to Earth is called downlink signal.

38 a



Block diagram of digital Computer

ALU → It performs the basic operation like arithmetic operations and also some of the logical operations involved in processing of output.

Memory unit → It stores the information in memory. That is it stores the input and corresponding output generated.

b $Y = \bar{A}B + B\bar{C}$

$= \bar{A}B(C + \bar{C}) + (A + \bar{A})B\bar{C}$

$= \bar{A}BC + \bar{A}B\bar{C} + AB\bar{C} + \bar{A}B\bar{C}$

$Y = \bar{A}BC + \bar{A}B\bar{C} + AB\bar{C}$

06

GOVERNMENT OF KARNATAKA
KARNATAKA STATE PRE-UNIVERSITY EDUCATION EXAMINATION BOARD
II YEAR P.U.C. EXAMINATION - MARCH - 2013
ADDITIONAL ANSWER SHEET

Answer Sheet No. 5317783 Reg. No. 3 8 3 4 6 7

Main Answer Book Sl. No. 1946835

Signature of the Invigilator with date

Part - B

19

Latch	Flip flop
1) Output of latch depends or remains same until next input pulse arrives. Output depends on ~~clock~~ pulse input.	1) Output is independent of clock pulse input and output changes with arriving of input pulse

2

18

Part - C

31

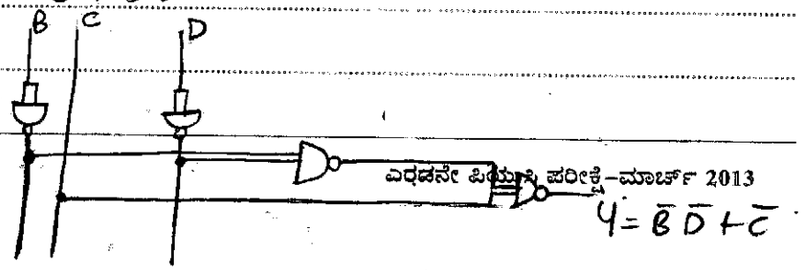
AB \ CD	$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
$\bar{A}\bar{B}$	1	1	0	1
$\bar{A}B$	1	1	0	0
AB	1	1	0	0
$A\bar{B}$	1	1	0	1

→ Grp 2 (0, 2, 8, 10)

Group 1 (0, 1, 4, 5, 8, 9, 12, 13)

4

1) There is one octet and 1 quad.
2) There is no pair and no isolated 1's
3) Output is $Y = \bar{C} + \bar{B}\bar{D}$



29 b

30 b

Part D

36 a b

37 a b