Academic year 2022-2023 (Even Sem)

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

Date	11 JULY 2023	Maximum Marks	50
Course Code	22ES24C	Duration	90 Min
Sem	II Semester	Test-1	

PRINCIPLES OF ELECTRONICS ENGINEERING

Sl. No.	Questions	M	BT	CO
1a.	Draw the circuit diagram of a Full wave Bridge rectifier circuit with filter and explain its operation along with suitable waveforms.	6	2	1
b.	In an amplifier, the output power is 1.5 watts at 2 kHz and 0.3 watt at 20 Hz, while the input power is constant at 10 mW. Calculate the difference in decibel gain between 20 Hz to 2 kHz.	4	2	2
2a.	In a Zener regulator circuit, Design the value of R so that circuit performs satisfactorily under all the given conditions. Given Pd(max) =6W Izmin =10mA, Vz=12V Vin varies from 22V to 28V R_L varies from 50Ω to 500Ω.	6	3	3
b.	Bring out any four differences between Avalanche breakdown and Zener breakdown.	4	1	2
3a.	A full wave bridge rectifier using ideal diodes is supplied from the secondary of a 10:1 transformer, whose primary is connected to 220V, 50Hz main supply. The output of the rectifier is connected to a load resistance of 220Ω in parallel with a capacitor filter C. Calculate the value of C required so that the ripple factor is 3%. Also determine: i) The dc output voltage ii) The peak to peak ripple voltage iii) The load regulation	6	3	3
b.	Write a brief note on the three regions of operation of a bipolar junction transistor.	4	2	1
4a.	Three stages are cascaded with $0.05V_{P-P}$ providing 150 V_{P-P} output. If the voltage gain of first stage is 20 and the input to the third stage is 15 V_{P-P}. Find the following. i) Overall gain in dB. ii) Voltage gain of 2^{nd} and 3^{rd} stages. iii) Voltage gain of each stage in dB.	6	2	3
b.	Explain the working principle of LED and Photodiode.	4	2	2
5a.	Draw the circuit diagram of a single stage RC coupled amplifier. With the	6	1	1

	help of frequency response, discuss the effect of capacitors in each region.			
b.	Draw the block diagram of a regulated DC power supply and explain the function of each block.	4	1	2

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	16	16	18	-	14	24	12	-	-	-

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RV Educational Institutions ®
RV College of Engineering ®
Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi
Approved by AICTE, New Delhi

Academic year 2022-2023 (Odd Sem)

DEPARTMENT OF **Electronics and Communication Engineering**			
Date	25/02/2023	**Maximum Marks**	60
Course Code	22ES14	**Duration**	120 Mins
Sem	I Semester	CIE2	
ELEMENTS OF ELECTRONICS ENGINEERING			

Instructions to candidates:

i. Part A must be answered within the first two pages of manuscript.

ii. Assume the suitable data for missing values

	PART-A	**M**	**BT**	**CO**
1	The Slew rate of an Op-Amp is 3V/µsec with a peak value of voltage as 2V. Calculate the maximum output frequency so that the output is not distorted.	1	2	2
2	If one of the input to a 2-input EX-NOR gate is connected to 0, then it can be used to _____	1	1	1
3	The canonical sum of product form of the function y(A,B) = A + B is _____	1	2	2
4	Prove that $AB + BC + B\bar{C} = AB + C$	1	3	2
5	The gain of a voltage follower is _____	1	1	1
6	An op-Amp has a differential gain of 86dB and Common mode gain of 20dB. The CMRR in dB is _____	1	2	3
7	The minimum number of NAND gates required to realize XOR gates is _____	1	2	1
8	State the necessary and sufficient conditions to obtain sustained oscillations	2	1	1
9	In a 3 variable K-map, if all the cells contain 1's then the output is_____	1	1	1
	PART-B			
1.a	Explain the operation of RC phase shift oscillator with a neat diagram and also mention the gain equation.	6	2	2
b	Prove that the stability of the gain of an amplifier improves with negative feedback by a factor (1+Aβ) where A is the open loop gain of the amplifier and β is the feedback factor.	4	3	2
2a	Simplify the logic expression using K map and implement the logic circuit using NAND Gate. $F = \sum m(0,1,2,3,,5,7,8,9,,10,12,13)$	6	4	3
2b	List at least four important characteristics of an ideal op–amp and indicate their typical values for a general purpose commercial op–amp.	4	1	1
3a	Simplify the following expressions: i. $Y = (A + B)(A + \bar{B})(\bar{A} + B)$ ii. $Y = XY + XYZ + XY\bar{Z} + \bar{X}YZ$	5	3	2
b	Design an adder circuit using an op-amp to obtain an output expression. $V_0=2(0.1\ V_1+0.5\ V_2+20\ V_3)$ where V_1, V_2, V_3 are the inputs. Assume the value of feedback resistor as 10KΩ.	5	4	4
4a	Define Slew rate and CMRR with necessary expressions	4	1	1
b	An amplifier has a gain of 50 dB. The bandwidth of 250KHz, distortion of 12%, an input impedance of 30KΩ, and an output impedance of 2KΩ. If the voltage series negative feedback of 2.9% is given to this amplifier, calculate the gain, input impedance, output impedance, bandwidth, and distortion of the amplifier with negative feedback.	6	4	3

5a	Write the truth table for SUM and CARRYOUT of a full adder. From the truth table, obtain the logic expressions for the same and then realize the full adder using 2 half adders.	6	3	3
5b	Draw the circuit of an inverting amplifier and explain the working of the same with suitable expressions	4	3	3

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Particulars			CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
Marks Distribution	Quiz	Max Marks	5	4	1	-	5	4	1	-	-	-
	Test	Max Marks	8	15	22	5	8	6	19	17	-	-

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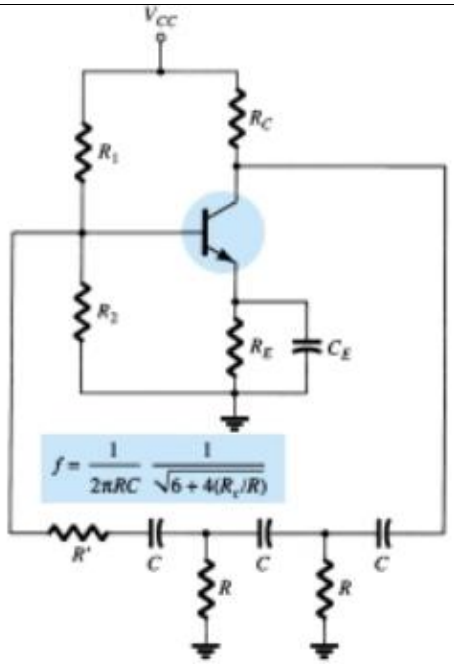
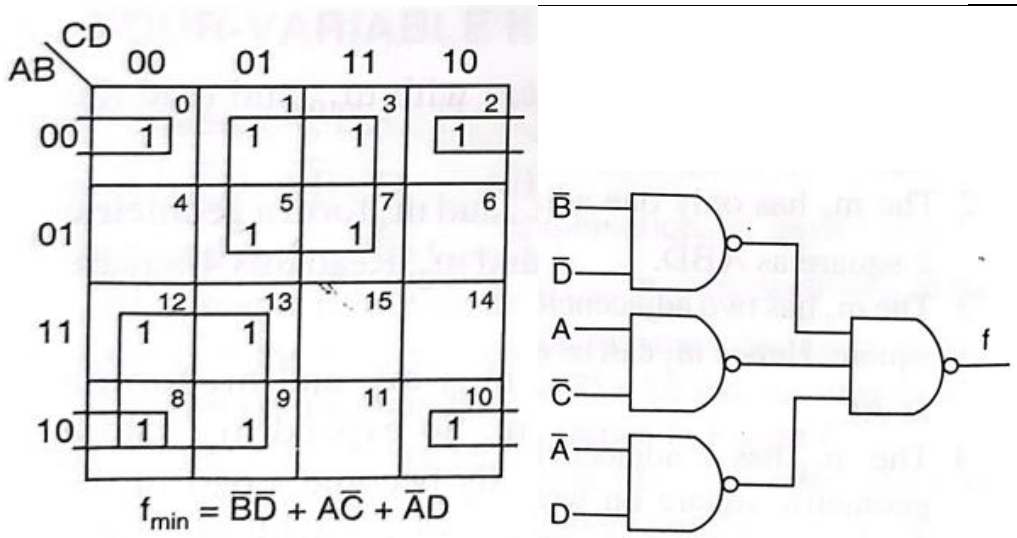
Course Code: 22ES14C
Course Title: **Principles of Electronics Engineering**
Semester: I

SCHEME & SOLUTION

Sl.No	Solution with Mark split-up	Marks allotted
1	$SR = \frac{dV_o}{dt}$ *volts* / μ sec $SR=f_{max}\,2\,\Pi\,V_m$ F=238.7KHz	01
2	Not	01
3	AB + AB′ + A′B.	01
4	$AB + BC + \bar{B}C = AB + C$ $AB + C(B + \bar{B}) = AB + C$	01
5	1	01
6	$\text{CMRR} = \frac{A_d}{A_c}$ 4.3dB	01
7	4	01
8	1. The loop gain is equal to one in absolute magnitude, which means that $\lvert\beta A\rvert=1$ 2. The phase shift through the loop is either zero or an integer multiple $\angle\beta A=2\pi n, n=0,1,2,\ldots$	02
9	1	01

Sl. No.	Solution with Mark split-up	Marks

1.a	 Working Frequency of oscillation $f = \frac{1}{2\pi RC\sqrt{6}}$ $\beta = \frac{1}{29}$ $A > 29$	2 2 1 1
1.b	$A = \frac{V_o}{V_s} = \frac{V_o}{V_i}$ If a feedback signal, V_f, is connected in series with the input, then $V_i = V_s - V_f$ Since $V_o = AV_i = A(V_s - V_f) = AV_s - AV_f = AV_s - A(\beta V_o)$ then $(1 + \beta A)V_o = AV_s$ so that the overall voltage gain *with* feedback is $A_f = \frac{V_o}{V_s} = \frac{A}{1 + \beta A}$ $\left\|\frac{dA_f}{A_f}\right\| = \frac{1}{\|1 + \beta A\|}\left\|\frac{dA}{A}\right\|$ $\left\|\frac{dA_f}{A_f}\right\| \cong \left\|\frac{1}{\beta A}\right\|\left\|\frac{dA}{A}\right\|$ for $\beta A \gg 1$	4

	This shows that magnitude of the relative change in gain $\left\|\frac{dA_f}{A_f}\right\|$ is reduced by the factor $\|\beta A\|$ compared to that without feedback $\left(\left\|\frac{dA}{A}\right\|\right)$.	
2.a		4+2
2.b	<table><tr><th>Parameter</th><th>Ideal</th><th>Typical or Practical Value</th></tr><tr><td>Voltage Gain [A_v]</td><td>∞</td><td>$2*10^5$</td></tr><tr><td>Output Impedance</td><td>0</td><td>75Ω</td></tr><tr><td>Input Impedance</td><td>∞</td><td>2MΩ</td></tr><tr><td>Input Offset</td><td>0</td><td>2mV</td></tr><tr><td>CMRR</td><td>∞</td><td>90dB</td></tr><tr><td>Slew Rate</td><td>∞</td><td>0.5V/μs</td></tr><tr><td>Bandwidth</td><td>∞</td><td>1MHz</td></tr><tr><td>PSRR</td><td>0</td><td>30μV/V</td></tr><tr><td>Input Bias Current</td><td>0</td><td>80nA</td></tr></table> To mention any Four	4
3.a	$Y = (A + B)(A + \bar{B})(\bar{A} + B)$ $= AB$ $Y = XY + XYZ + XY\bar{Z} + \bar{X}YZ$ $Y = Y[X + Z]$	2.5 2.5
3.b	$V_o = \left[\frac{R_f}{R_1}V_1 + \frac{R_f}{R_2}V_2 + \frac{R_f}{R_3}V_3\right]$ R_1=50KΩ, R_2=10KΩ and R_3=250Ω Design	1 3 1
4.a	slew rate is the maximum rate at which amplifier output can change in volts per	2

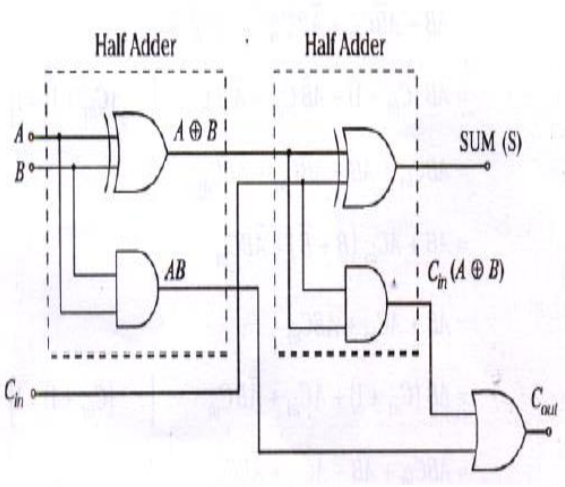
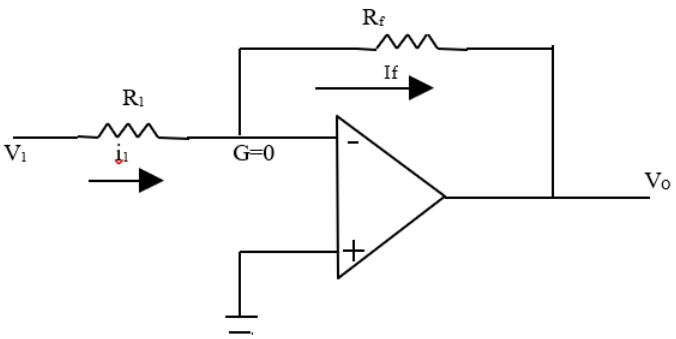
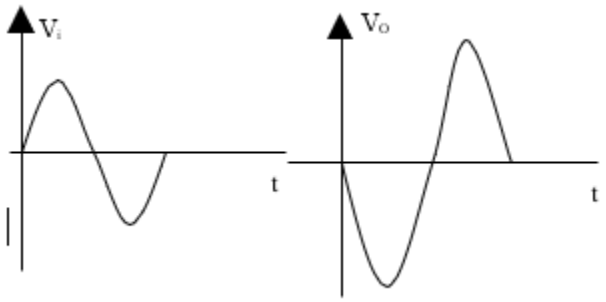
	microsecond (V/microsecond) $SR = \frac{\Delta V_o}{\Delta t}$ V/μs with t in μs **Common Mode Rejection Ratio(CMRR):** It is defined as " The ratio of differential voltage gain to common-mode voltage gain". $CMRR = \frac{A_d}{A_c}$	2
4.b	Gain=50/(1+1.45)=20.408 Input impedance=30K*(1+1.45)=73.5KΩ Output impedance=2K/(1+1.45)=816.32Ω Bandwidth=250K*2.45=612.5KHz Distortion of the amplifier with negative feedback=4.89%	6
5.a		2

Inputs			Outputs	
A	B	C_{in}	Carry	Sum
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

$$\begin{aligned}
\text{Sum} &= \bar{A}\,\bar{B}\,Cin + \bar{A}\,B\,\overline{Cin} + A\,\bar{B}\,\overline{Cin} + ABCin \\
&= \bar{A}\,[\bar{B}\,Cin + B\,\overline{Cin}] + A[\bar{B}\,\overline{Cin} + BCin] \\
&= \bar{A}\,[B \oplus Cin] + A[\overline{B \oplus Cin}] \\
&= A \oplus B \oplus Cin
\end{aligned}$$

$$\begin{aligned}
\text{Carry} &= \bar{A}BCin + A\,\bar{B}\,Cin + AB\,\overline{Cin} + ABCin \\
&= \bar{A}BCin + A\,\bar{B}\,Cin + AB(\overline{Cin} + Cin) \\
&= \bar{A}BCin + A\,\bar{B}\,Cin + AB \\
&= \bar{A}BCin + A(\bar{B}\,Cin + B) \\
&= \bar{A}BCin + AB + ACin \\
&= B(\bar{A}\,Cin + A) + ACin \\
&= B(A + Cin) + ACin \\
&= AB + BCin + ACin
\end{aligned}$$

2

		2
5.b	  $\boldsymbol{A_v = \frac{V_o}{V_i} = \frac{-R_f}{R_1}}$ Working	1 1 1 1

Signature (Digital) of course handling faculty

1. Dr. Abhay Deshpande
2. Dr. Sahana B
3. Prof. Sowmya Nag
4. Dr. Saba
5. Prof. Sindhu