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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

I / II Semester B. E. Regular / Supplementary Examinations Feb-2024

Common to EC / ET /EI

BASIC ELECTRONICS

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. Question number 2 is compulsory. Choose any one full question from 3 or 4, 5 or 6, 7 or 8 and 9 or 10.

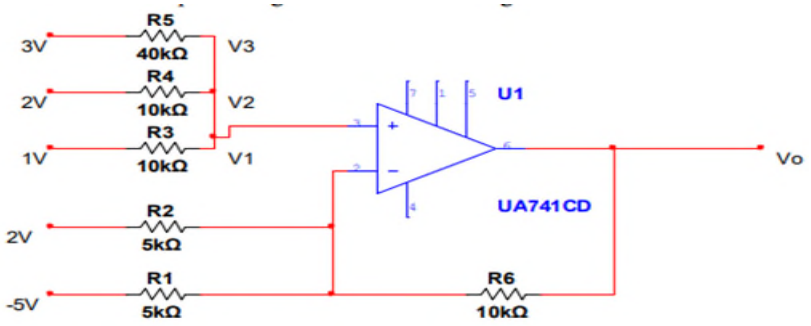
PART-A

1	1.1	A DC power supply has NO load voltage of $30V$ and a full load voltage of $25V$ at a full load current of $1A$. Calculate the load regulation and its output resistance.	02
	1.2	In a NPN transistor, if the base emitter junction is reverse biased and the collector to base junction is reverse biased, the transistor is operating in the _____ region.	01
	1.3	An NPN transistor has $I_{co} = 25nA, I_B = 0, V_{CE} = 4V$ and $I_C = 20\mu A$. The value of β is _____.	01
	1.4	In a voltage divider circuit, for a silicon transistor having $\beta = 49$ has $R_E = 4K\Omega$ and $R_{th} = 60K\Omega$, $S(I_{co})$= _____.	01
	1.5	An amplifier has a voltage gain of 100 at $1kHz$. The gain falls by $6dB$ at $1MHz$. If the input is $3mW$ at $2MHz$, then the output voltage is _____.	02
	1.6	The output of a cascaded chain of four amplifiers is $4V$, when the input voltage is $0.5mV$. If the voltage gains of the first, third and fourth stages are $28dB$, $0dB$ and $12dB$ respectively, the voltage gain of the second stage in dB is _____.	01
	1.7	An N-channel $MOSFET$, having $V_t = 1V$, is biased such that $V_G = 4V$. The maximum value of V_D allowed, so that the device operates in ohmic region is _____.	01
	1.8	A $MOSFET$ uses the electric field of a _____ to control the channel current.	01
	1.9	The open loop and closed loop gains of an amplifier are $66dB$ and $40dB$ respectively. The amount of negative feedback in dB is _____.	01
	1.10	An amplifier without feedback has a gain of 100 and a bandwidth of $500kHz$. If 5% negative feedback is given, then the bandwidth with feedback is _____.	01
	1.11	$(AB' + AB + A'B) =$ _____.	01
	1.12	If any one of the inputs of a $EX-NOR$ gate is always connected to LOW, then the $EX-NOR$ gate behaves as _____.	01

	1.13	The total number of gates required to implement 64:1 multiplexer is _____.	01
	1.14	An operational amplifier has a differential gain of 100 and a common mode gain of 0.1. The $CMRR$ in dB is _____.	01
	1.15	The slew rate of an op amp used as a voltage follower is $5V/\mu s$. If the input voltage is $20sin6.28wt$, the maximum frequency of the input so that the output is not distorted is _____ kHz.	01
	1.16	For an AM signal, the bandwidth is $10kHz$ and the highest frequency component present is $705kHz$. The carrier frequency used for this AM signal is _____.	01
	1.17	A $400W$ carrier is modulated to a depth of 75%. Assuming the modulating signal to be sinusoidal the total power in the amplitude modulated wave is _____.	01
	1.18	A part of the transducer which responds to a change in the physical phenomenon is called _____.	01

PART-B

2	a	Draw the block diagram of a DC power supply and explain the function of each block.	04
	b	In a RC coupled CE amplifier, $R_1 = 90k\Omega$, $R_2 = 10k\Omega$, $R_E = 0.68k\Omega$, $R_c = 2.2\ k\Omega$ $V_{cc} = 16V$ and $\beta = 210$. Determine Z_i, Z_o and A_v of the transistor. Draw the re model for the same.	08
	c	Explain the different operating regions of a transistor along with the applications and draw the output characteristics for transistor in common emitter configuration.	04
3	a	With neat diagram explain the structure and working of $N-channel$ enhancement type $MOSFET$. Draw the plot of I_D versus V_{GS} and I_D versus V_{DS}. Write the current equation at different regions of operation.	07
	b	An $N-channel\ MOSFET$ has a threshold voltage $V_t = 0.9V$ and $I_D = 0.75mA$,when $V_{GS} = V_{DS} = 2.5V$. Calculate: i) Drain current, if $V_{GS} = 4.1V$ and $V_{DS} = 4.0V$. ii) Drain to source resistance r_{ds} for small values of V_{DS}, if $V_{GS} = 4.9V$ iii) Trans conductance, $g_m, if\ V_{GS} = 4.9V$	05
	c	Explain the operation of $CMOS\ NAND$ gate	04
		OR	
4	a	Write the advantages of providing a negative series feedback to a voltage amplifier.	04
	b	An amplifier has a gain of $60dB$, bandwidth of $30kHz$, distortion of 15%, input impedance of $5k\Omega$ and an output impedance of $1k\Omega$. If voltage series negative feedback of 3.9% is given to this amplifier, calculate the gain, input impedance, output impedance, distortion, bandwidth and amount of feedback for a closed loop amplifier.	06
	c	Draw the circuit and explain the operation of a two input $CMOS\ NOR$ gate along with the truth table.	06

5	a	The four variable function f is given in terms of min-terms as: $f(A,B,C,D) = \sum m\,(0,1,2,3,4,6,8,9,10,11,12,14)$ .Using the $K-map$ minimize the function in the sum of products form and realize the expression using only $NAND$ gates.	08
	b	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 two half adders.	08
		OR	
6	a	A logic circuit has 3 inputs A, B and C and 2 outputs X and Y. Output X is 1, only when any two of the inputs are at 1 and Y is 1, only when any one of the inputs is at 1. Write the truth table and the logic expressions for X and Y. Also realize the logic circuit using basic gates.	08
	b	Explain the operation of 8:1 multiplexer along with the truth table and logic expression. Also draw the logic circuit to realise the multiplexer.	08
7	a	List at least eight important characteristics of ideal op-amp and indicate their typical practical values.	04
	b	Draw the circuit and design the values of different resistors of a summer circuit using 2 ideal op amps to get an output voltage $V_o = V_1 + 3V_2 + 5V_3 - 7V_4 - 9V_5 - 11V_6$ where V_1, V_2, V_3, V_4, V_5 and V_6 are available input voltages.	06
	c	Draw the circuit of a Schmitt trigger using an ideal op amp and explain its operation with necessary waveforms.	06
		OR	
8	a	Draw the circuit of a differentiator using an ideal op amp and derive the expression for the output voltage.	06
	b	Calculate the output voltage for the circuit in Fig. 8.b  Fig. 8.b	06
	c	Explain the working of negative comparator with input output waveforms.	04
9	a	What is the need for modulation? Write eight differences between AM and FM.	08
	b	Explain the working of a piezoelectric transducer with relevant equations.	08
		OR	

10	a	A carrier signal of $1MHz$ with $400W$ of its power amplitude modulated with a sinusoidal signal of $2500Hz$. The depth of modulation is 75%. Calculate the sideband frequencies, the bandwidth, the power of the sidebands and total power in the modulated wave and sketch the frequency spectrum when amplitude of the carrier signal is $3V$.	08
	b	With the help of a neat diagram, discuss the working principle of $LVDT$.	08