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# RV COLLEGE OF ENGINEERING®

**(An Autonomous Institution affiliated to VTU)**

**I / II Semester B. E. Fast Track Examinations Oct-2020**

## Common to All Branches

## ELEMENTS OF ELECTRONICS ENGINEERING

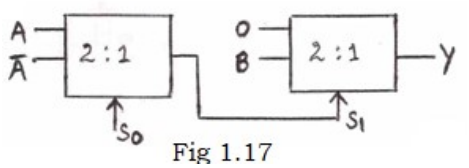
***Time: 03 Hours*** ***Maximum Marks: 100***

***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. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

**PART-A**

| | | | |
|---|---|---|---|
| 1 | 1.1 | In a full wave bridge rectifier with capacitor filter, the value of capacitance required to get ripple factor zero is _____. | 01 |
| | 1.2 | With a constant forward current, if the forward voltage drop of germanium diode at $25°C$ is $300mv$, its voltage drop at $35°C$ is _____. | 01 |
| | 1.3 | If $V_E$=11V, $V_B$=2V, $V_C$=3V for a NPN transistor, the region of operation is _____. | 01 |
| | 1.4 | In a regulated $DC$ power supply, the output voltage drops from $18V$ to $17.2\,V$ when the input voltage is reduced by 10%. The % line regulation is _____. | 01 |
| | 1.5 | For plotting the output characteristic of $CE$ configuration using $NPN$ transistor, the parameter in an $X$ axis is _____. | 01 |
| | 1.6 | The ratio of current gain $IC\,/\,IE$ is usually less than one for _____ configuration. | 01 |
| | 1.7 | The logic gate which has output 'low' only when all its inputs are 'high' is _____. | 01 |
| | 1.8 | The gain of a $RC$ coupled amplifier decreases at higher frequency due to _____. | 01 |
| | 1.9 | A voltage amplifier has an open loop gain of 500 and gain stability of 12%. If 1% of negative feedback is given, the gain stability of amplifier with feedback is _____. | 01 |
| | 1.10 | A $MOSFET$ is _____ controlled device. | 01 |
| | 1.11 | In a $CMOS$ inverter, if the input logic is 1, then the $PMOS$ is in _____ State. | 01 |
| | 1.12 | A $10V$ sinusoidal carrier signal is amplitude modulated by two sine waves of amplitude $6V$ and $8V$, the resultant modulation index is _____. | 01 |
| | 1.13 | With negative feedback, the bandwidth of an amplifier _____ by a factor of $(1 + A\beta)$. | 01 |
| | 1.14 | An $AM$ modulated signal has _____ number of sidebands. | 01 |
| | 1.15 | Simplify, $Y = \bar{A}B + \bar{B}C$ | 01 |
| | 1.16 | In a 1 to 32 demultiplexer, the number of select bits are _____. | 01 |

| | | | |
|---|---|---|---|
| | 1.17 | Write a simplified expression for $Y$ for the multiplexer arrangement shown in fig 1.17<br>  <br><br>Fig 1.17 | 01 |
| | 1.18 | The minimum number of $NAND$ gates required to realize Half adder is _____. | 01 |
| | 1.19 | An Op-amp has $CMRR$ of $60dB$ and differential gain of 1000. Determine the output voltage if $V_1 = 199mv$ and $V_2 = 201mV$ | 02 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Write the expression relating the current and voltage of a PN junction diode. From this obtain the expression for its dynamic resistance | 04 |
| | b | Explain the term 'Reverse recovery time' of a PN junction diode with relevant waveform | 04 |
| | c | The input to the primary of a step down transformer feeding a full wave bridge rectifier is $100\,sin\,314t$. The $DC$ output voltage with a resistive load of $900\Omega$ is $10V$. Assuming that each of the diodes used has a forward resistance of $50\,\Omega$, determine the transformer turns ratio. | 04 |
| | d | Explain briefly the operating principles of $LED$ and photodiode. Give their applications. | 04 |
| | | | |
| 3 | a | Give the comparison between the performance of the three $BJT$ amplifier configurations. | 04 |
| | b | Explain the terms briefly<br>i) Punch through effect<br>ii) Bias Stabilization in a $BJT$ | 04 |
| | c | In $RC$ coupled $CE$ amplifier circuit, $V_{CC} = 12V$; $R_1 = 120\Omega$; $R_2 = 40\Omega$; $R_E = 1.5K\Omega$; $R_C = 2.7\,K\Omega$ and $\beta = 99$. Determine the operating point, $S_{(ICO)}$, voltage gain, input impedance and output impedance | 08 |
| | | **OR** | |
| 4 | a | Draw the circuit and explain the frequency response of an $RC$ coupled amplifier | 05 |
| | b | List the advantages of voltage series negative feedback. Prove any one of them. | 05 |
| | c | A Voltage amplifier needs $2mv$ input to give a $10V$ output. When negative feedback is provided to this amplifier, it needs $200\,mv$ to deliver the same output. Determine the open loop gain, closed loop gain, feedback factor and amount of feedback in dB for this amplifier. | 06 |
| | | | |
| 5 | a | Draw the structure of $N$ channel $MOSFET$ and explain its operation along with its output characteristics. Write the necessary conditions for the different regions of operation. | 06 |
| | b | An $NMOS$ having $V_t = 0.6V$, it has a drain current, $I_D = 0.4mA$ when $V_{GS} = V_{DS} = 2.6V$<br>i) Determine its drain current when $V_{GS} = 3.6\,V$ and $V_{DS} = 4V$<br>ii) Find the resistance between the source and drain for small values of $V_{DS}$ when $V_{GS} = 5.6V$ | 06 |
| | c | List eight differences between $AM$ and $FM$. | 04 |

| | | | |
|---|---|---|---|
| | | **OR** | |
| 6 | a | With a neat circuit and truth table, explain the construction and working of two input $CMOS\ NOR$ gate. | 04 |
| | b | List eight differences between $BJT$ and $FET$. | 04 |
| | c | A modulated wave is given by, $v(t) = (10 + 16cos\ 2 \times 10^4\ t)\ sin\ 4 \times 10^6\ t$ Calculate:<br>i) sideband frequencies and their amplitude<br>ii) The Bandwidth<br>iii) The min and max values of peak to peak voltage of the modulated signal<br>iv) The total power, if the load is 100Ω | 05 |
| | d | What is frequency spectrum? Draw the frequency spectrum of $AM$ wave | 03 |
| | | | |
| 7 | a | A logic circuit has two inputs $P, Q$ and an output $Y$. The output is false when either of the two inputs are true but not both. Write the logic expression and realize using only $NOR$ gate. | 04 |
| | b | Draw the truth table for 'sum' and 'carry' of a full adder. From the truth table obtain the logic expression, from these expressions realize the full adder using two half adders. | 06 |
| | c | Write the truth table of $4{:}1\ MUX$. Realize using $NAND$ gates and obtain expression for the output $Y$ | 06 |
| | | | |
| 8 | a | List the characteristics and typical values of general purpose op-amp. | 04 |
| | b | Draw the circuit of an Integrator using ideal $OPAMP$ and show that output is integral of input. Write output waveform for square wave input | 06 |
| | C | Draw the summer circuit using two ideal op-amps, and calculate the different resistor values to obtain $V_0 = V_1 + 3V_2 + 5V_3 - 7V_4 - 9V_5 - 11V_6$, where $+V_1, +V_2, +V_3, +V_4, +V_5, +V_6$ are the available inputs. | 06 |

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# RV COLLEGE OF ENGINEERING®

**(An Autonomous Institution affiliated to VTU)**

**I / II Semester B. E. Examinations Nov/Dec-19**

## Common to All Branches

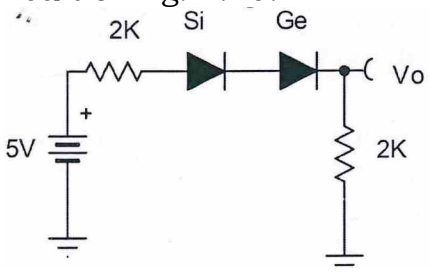
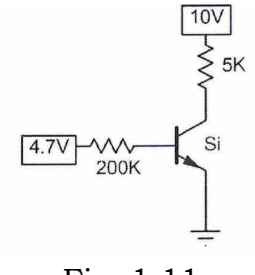
## BASICS OF ELECTRONICS ENGINEERING

***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. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

**PART-A**

| | | | |
|---|---|---|---|
| 1 | 1.1 | The simplified expression of $A + AB + ACD$ is _____. | 01 |
| | 1.2 | Write the truth table for 1: 4 Demux. | 01 |
| | 1.3 | The value of the dynamic resistance ($r_d$) of a $PN$ junction diode at an ambient temperature of 27°C and a forward DC current of $2\,mA$ is _____. | 01 |
| | 1.4 | In a transistor if $\alpha$ changes from 0.99 to 0.995, then $\beta$ changes from _____ to _____. | 01 |
| | 1.5 | Three oscillators are cascaded to provide an overall voltage gain of 10,000. The first two stages have gains of $34dB$ and $20dB$. Find the gain of third stage amplifier in dB. | 01 |
| | 1.6 | In a RC phase shift oscillator circuit, using an ideal voltage amplifier, the frequency of oscillation is $1kHz$. If $C = 0.01\mu F, R$ is equal to _____. | 01 |
| | 1.7 | A $25MHz$ carrier is frequency modulated by $400Hz$ audio sine wave. The carrier voltage is $4V$ and maximum deviation is $1kHz$. Write the equation of this. | 02 |
| | 1.8 | Realize $EX-OR$ function using basic gates. | 02 |
| | 1.9 | List four differences between a bipolar transistor and a field effect transistor. | 02 |
| | 1.10 | Determine the current, $I$ through the diode and the output voltage $V_o$ in the circuit of Fig. 1.10.   Fig. 1.10   Fig. 1.11 | 02 |
| | 1.11 | In the invertor circuit of Fig. 1.11. Find Base Current ($I_B$) and Collector current ($I_C$) when invertor is operating in saturation. | 02 |
| | 1.12 | An N Channel enhancement $MOSFET$ with threshold voltage $V_T = 1V$ has its source voltage $V_S = 2V$. If its gate voltage $V_G = 4V$. Find the minimum drain voltage $V_D$ needed for the device to operate in saturation region. | 02 |
| | 1.13 | In the circuits of Fig. 1.13, determine the output voltage $V_O$. Assume the op amp to be ideal. | |

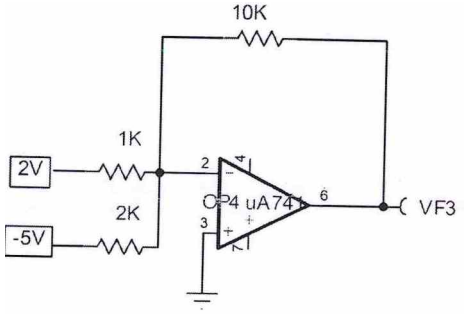
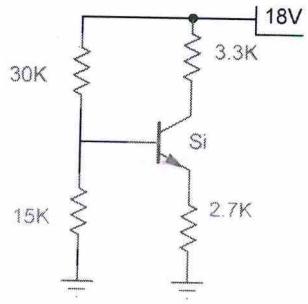



Fig. 1.13 — 02

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Explain the operation of a $4-to-1$ multiplexer and write the logic expression for its output. Also draw the logic circuit to realize the multiplexer. | 04 |
| | b | Draw the truth table for $'SUM'$ and $'CARRY\ OUT'$ of a FULL ADDER. From the truth table, obtain the logic expressions for them. From these expressions, realize the FULL ADDER using logic gates. | 06 |
| | c | Write the equation that related voltage across the $PN$ junction diode and current through it. Obtain the expression for the dynamic resistance $r_d$, of a forward biased $PN$ junction diode. | 06 |
| | | | |
| 3 | a | Distinguish between 'Avalanche breakdown' and 'Zener breakdown'. | 04 |
| | b | A full wave bridge rectifier using ideal diodes is supplied from a secondary of $10:1$ transformer is primary is connected to $200V, 50Hz$ main supply. The output of the rectifier is connected to a resistance of $330\Omega$, in parallel with a capacitor filter $C = 1500\mu F$. Determine:<br>i) DC Output Voltage,<br>ii) Peak-Peak Ripple Voltage,<br>iii) Ripple Factor,<br>iv) Load regulation. | 06 |
| | c | Determine the operating point of silicon transistor in the voltage divider biasing circuit shown in Fig. 3.c. Also, determine $S(ICO)(Take\ \beta = 100)$.<br>  <br><br>Fig. 3.c | 06 |
| | | **OR** | |
| 4 | a | Draw the circuit diagram of Full wave bridge rectifier with capacitor filter and describe its working with necessary waveforms. | 03 |
| | b | In a Zener regulator circuit of Fig. 4.b. Design the value of $'R'$ so that the regulator performs satisfactorily for all given input voltage and load conditions. Given $I_{Z,min} = 10mA\ and\ P_{Z,max} = 6W$. | 05 |

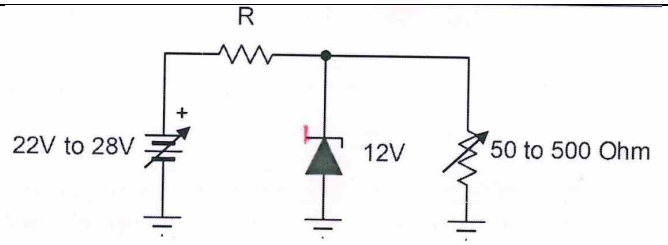



Fig. 4.b

| | | | |
|---|---|---|---|
| | c | In Fig. 4.c, determine $R_C, R_1$ *and* $R_2$, so that $V_{CEQ} = 4V$ *and* $I_{CQ} = 1mA$, with a bias stabilization factor, $S(I_{CO}) = 10$. | |

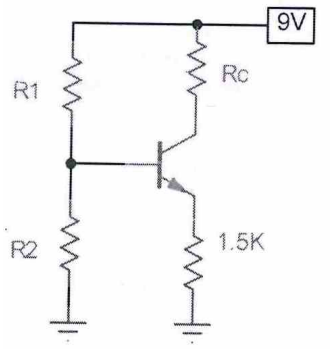



Fig. 4.c

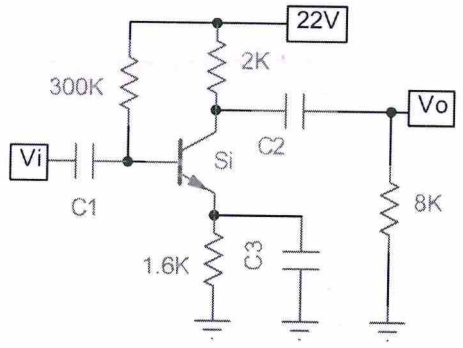



Fig. 5.b

08

| | | | |
|---|---|---|---|
| 5 | a | State and explain the Barkhausen criterion for sustained sinusoidal oscillations. | 04 |
| | b | Calculate the voltage gain, current gain, input impedance $Z_i$ and output impedance $Z_o$ for the circuits in Fig. 5.b. (Take $\beta = 79$). | 06 |
| | c | An amplifier has a gain of $60dB$, bandwidth of $300kHz$, distortion of 15%, input impedance of $20k\Omega$ 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, bandwidth and distortion of the amplifier with negative feedback. | 06 |
| | | **OR** | |
| 6 | a | Draw and explain the working of following using CMOS circuits i) Invertor and ii) NAND gate. | 04 |
| | b | Draw the circuit and explain the functioning of an RC phase shift oscillator using a common emitter amplifier and write the expression for the frequency of oscillation. | 06 |
| | c | An N-channel enhancement type $MOSFET$ with $V_{th} = 1V$ conducts a current $I_D = 100\mu A$ when $V_{GS} = V_{DS} = 1.5V$. Find the value of $I_D$ for $V_{GS} = 2.5V$ *and* $V_{DS} = 4V$. Also calculate the value of $r_{DS}$ for small value of $V_{DS}$, when $V_{GS} = 3V$. | 06 |

| | | | |
|---|---|---|---|
| 7 | a | Draw the circuit of an integrator using an ideal op-amp and prove that it works as an integrator. | 04 |
| | b | Draw the circuit and calculate the values of different resistors of a summer circuit using two ideal op-amps to obtain an output of $V_o = V_1 - 2V_2 - 4V_3 + 6V_4$, where $+V_1, +V_2, +V_3$ *and* $+V_4$ are the available inputs. | 06 |
| | c | Write a block diagram Data acquisition system and explain the function of each stage. | 06 |
| 8 | a | Write EIGHT differences between AM and FM systems. | 04 |
| | b | Draw the block diagram of a communication system and explain the function of each stage. | 06 |
| | c | A carrier of $1MHz$ with $400W$ of its power is amplitude modulated with sinusoidal signal of $2500Hz$. The depth of modulation is 75%. Calculate the side band frequencies, Bandwidth, the power in side band and total power in modulated wave. | 06 |

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**I Semester B. E. Examinations Nov/Dec-19**

## Common to All Branches

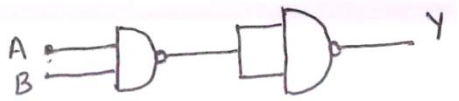
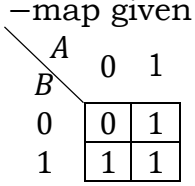
## ELEMENTS OF ELECTRONICS ENGINEERING

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

***Instructions to candidates:***

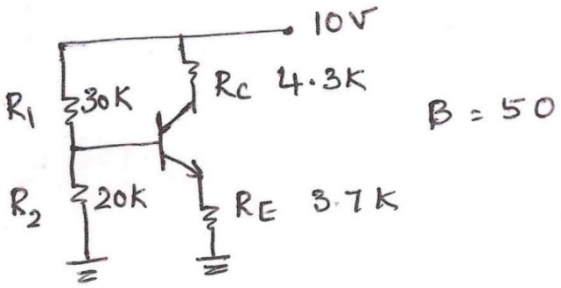
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

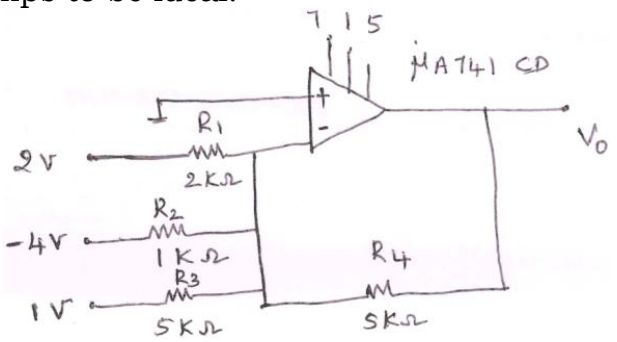
**PART-A**

| | | | |
|---|---|---|---|
| 1 | 1.1 | The current and voltage relationship of a semiconductor diode is =_____. | 01 |
| | 1.2 | The reverse saturation current of a diode _____ for every $10^0C$ rise in temperature. | 01 |
| | 1.3 | In a full wave bridge rectifier without any capacitor, each of the diodes used has a forward resistance of 20Ω and the load resistance is $2k\Omega$. The load regulation of the rectifier is _____. | 02 |
| | 1.4 | The zener resistance of a zener diode which exhibits resistance of $50mV$ change in $V_z$ for a $2.5mA$ change in $I_z$ is _____. | 01 |
| | 1.5 | The peak inverse voltage of a bridge rectifier without any filter is =_____. | 01 |
| | 1.6 | The emitter base junction of a $CE$ transistor is forward biased and collector base junction is reverse biased. The transistor is working in _____ region. | 01 |
| | 1.7 | A voltage divider circuit has $V_{cc} = 15V, R_1 = 22k\Omega$, $R_2 = 12k\Omega$, $R_c = 2.7k\Omega$ The value of Thevenin voltage $V_{Th}$=_____. | 01 |
| | 1.8 | An amplifier has an open loop gain of 1000. If 10% negative voltage series feedback is used, find the closed loop voltage gain. | 01 |
| | 1.9 | An amplifier has a bandwidth of $500kHz$. If the lower cutoff frequency is $25Hz$ what is its upper cutoff frequency? | 01 |
| | 1.10 | $MOSFET$ is a _____ controlled source. | 01 |
| | 1.11 | Find the value of $r_{ds}$ for the small value of $V_{DS}$ when $V_t = 0.7V$, $V_{GS} = 3.2V$, $k = 2mA/V^2$. | 02 |
| | 1.12 | Two sinusoidal signals of modulation indices 0.6 *and* 0.8 are transmitted over $AM$ transmitter simultaneously. Obtain the total modulation index. | 01 |
| | 1.13 | Fig 1.13 is _____.   Fig 1.13 | 01 |
| | 1.14 | The output of two variables $k$ −map given in Fig 1.14 is _____.   Fig 1.14 | 01 |

| | | | |
|---|---|---|---|
| | 1.15 | In $XOR$ gate, if all the inputs are same, then output is = _____. | 01 |
| | 1.16 | The typical value of input resistance for idea opamp is _____. | 01 |
| | 1.17 | The output signal of an opamp with a slew rate of $2V/\mu s$ has a maximum value of $10V$. Then the maximum frequency for undistorted output voltage is _____. | 01 |
| | 1.18 | For the truth table given in Table 1.18, identify the gate.<br>Table 1.18<br>$A$ \| $B$ \| $y$<br>0 \| 0 \| 1<br>0 \| 1 \| 1<br>1 \| 0 \| 1<br>1 \| 1 \| 0 | 01 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Draw the circuit of full wave bridge rectifier with capacitor filter and explain its working principle with relevant waveforms. Obtain the expression for output $DC$ voltage across the load. | 06 |
| | b | A $24V, 600mW$ Zener diode is used for providing a $24V$ stabilized supply to a variable load. If the input voltage is $32V$, determine:<br>i) Value of series resistance required,<br>ii) Diode current when the load is $1200\Omega$. | 06 |
| | c | Write the equation that represents the $VI$ characteristic of $pn$ junction diode. From this equation, obtain the expression for the dynamic resistance $r_d$ of the diode. | 04 |
| | | | |
| 3 | a | Determine the operating point of silicon transistor in the voltage divider biasing circuit in Fig 3a. Also determine $S_{ICO}$.<br>  <br><br>Fig 3a | 06 |
| | b | Explain the following with respect to $BJT's$:<br>i) Thermal runaway,<br>ii) Bias stabilization. | 04 |
| | c | List out any three advantages of negative feedback amplifier. Also prove that gain feedback decreases by a factor of $(1 + A\beta)$ compared to that of the amplifier withour feedback, where $'A'$ is the open loop gain and $'\beta'$ is the feedback factor. | 06 |
| | | **OR** | |
| 4 | a | Explain the working of $RC$ coupled amplifier with the circuit diagram. Draw its frequency response and briefly explain 3 regions. | 06 |
| | b | An amplifier has a gain of $50dB$, bandwidth of $400kHz$, distortion of 10%, input impedance of $20k\Omega$ and an output impedance of $1k\Omega$. If voltage series negative feedback of 4% is given to the amplifier, calculate the gain, input impedance, output impedance, bandwidth and distortion of the amplifier with negative feedback. | 06 |

| | | | |
|---|---|---|---|
| | c | An amplifier having a power gain of $20dB$ delivers a power output of $40W$ to a load of $10k\Omega$. Calculate:<br>i) Input power needed,<br>ii) Input voltage needed, if the voltage gains of the amplifier is $40dB$. | 04 |
| | | | |
| 5 | a | Draw the circuit diagram and explain the operation of a two input $CMOS\ NAND$ gate. | 06 |
| | b | An $N-$channel enhancement type $MOSFET$ with $V_{Th} = 0.7,\ I_D = 200\mu A$ when $V_{GS} = V_{DS} = 1.2V$. Find the drain current and transconductance when $V_{GS} = 1.5V$ and $V_{DS} = 3V$. | 04 |
| | c | With the help of neat block diagram of communication system, explain the function of each of the blocks. | 06 |
| | | **OR** | |
| 6 | a | Explain the operation of an $N-$channel enhancement $MOSFET$ with a suitable diagram along with its output characteristics. | 06 |
| | b | List out any eight differences between AM and FM systems. | 05 |
| | c | If amplitude modulated transmitter radiates $20kW$ and has a modulation index of $0.6$, then calculate the:<br>i) Carrier power and power of each sideband,<br>ii) If total antenna current is $5A$, calculate the antenna current when only the current is sent i.e. carrier current. | 05 |
| | | | |
| 7 | a | Simplify the following expression.<br>i) $Y = (A + \bar{B} + C)(\bar{A} + \bar{B} + \bar{C})(\bar{A} + B)$ using Boolean postulates and $D$-Morgan's law,<br>ii) $F(a,b,c) = \bar{a}bc + b\bar{c}a + a\bar{b}c$ using $K$-map. | 04 |
| | b | Write the truth table for the sum and carry out of a full adder. From the truth table, obtain the logic expression and realize the logic circuit using two half adders. | 06 |
| | c | Explain the operation of a $1:4$ Demux with necessary truth table, logic expression and logic circuit. | 06 |
| | | | |
| 8 | a | List at least eight characteristics of an ideal op-amp and indicate their typical values for a practical op-amp. | 06 |
| | b | Design an integrator using an op-amp. | 06 |
| | c | In the circuit shown in Figure 8c, determine the output voltage $V_o$, assuming op-amps to be ideal.<br>  <br><br>Figure 8c | 04 |

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# RV COLLEGE OF ENGINEERING®

**(An Autonomous Institution affiliated to VTU)**

**I / II Semester B. E. Examinations April 2021**

## Common to All Branches

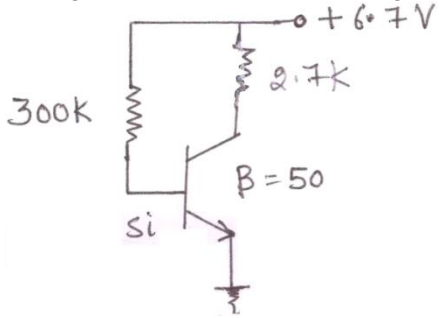
## BASICS OF ELECTRONICS ENGINEERING

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

***Instructions to candidates:***

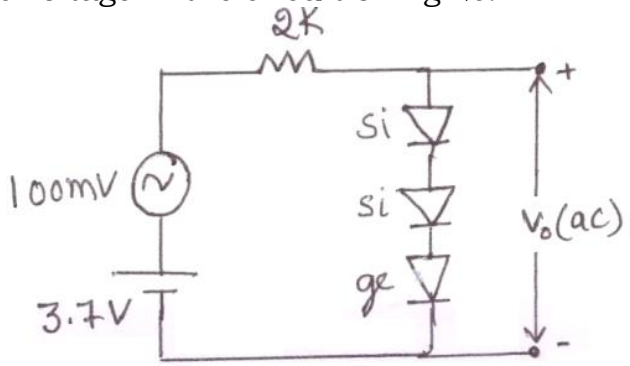
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

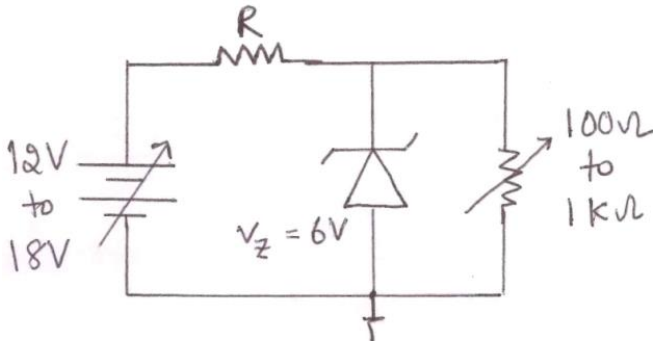
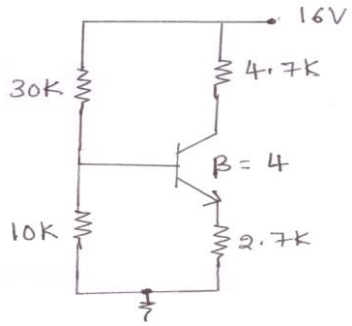
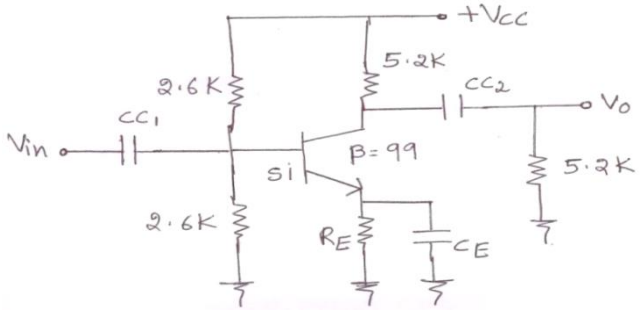
### PART-A

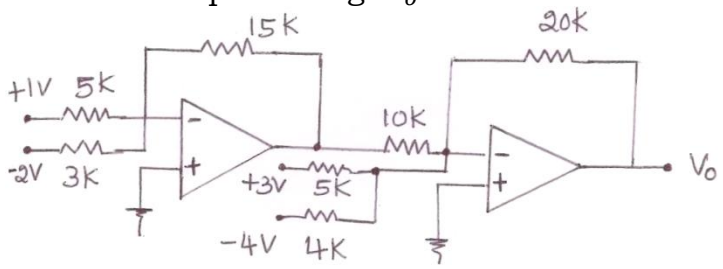
| | | | |
|---|---|---|---|
| 1 | 1.1 | Simplify the following logic expression using Boolean postulates: $Y = \overline{(A+B)(\bar{A}+\bar{B})}$ | 01 |
| | 1.2 | The number of basic gates required to realize $1:4$ demultiplexer is _____. | 01 |
| | 1.3 | The maximum power which can be dissipated at $80^0C$ in a diode having maximum power dissipation of $1W$ at $25^0C$ with a derating factor of $5mW/^0C$ is equal to _____. | 01 |
| | 1.4 | The dynamic resistance of a $Si$ diode at $57^0C$ is 14.3Ω. The dc forward current through the diode is _____. | 01 |
| | 1.5 | The output voltage of a $DC$ power supply drops from $14V$ to $13.7V$ when the input voltage reduces by 10%. The line regulation is _____. | 01 |
| | 1.6 | The ac input to a full wave bridge rectifier is $100 \sin \omega t$. The reverse breakdown voltage capability required for diodes used in the above rectifier = _____. | 01 |
| | 1.7 | In a transistor, if $\beta$ changes from 99 to 199, then $\alpha$ changes from _____ to _____. | 01 |
| | 1.8 | In the circuit of Fig 1.8, $I_C$ = _____ and $V_{CE}$ = _____.   Fig 1.8 | 02 |
| | 1.9 | In a common emitter amplifier circuit, the dc emitter current is $0.25mA$ and the collector resistance is $2.6k\Omega$. The voltage gain of the amplifier is _____. | 01 |
| | 1.10 | The gain of an $RC$ coupled amplifier decreases at low frequencies because of _____. | 01 |
| | 1.11 | An $n$ −channel enhancement $MOSFET$ having $V_t = 0.5V, K = 2mA/V^2$ is biased such that $V_{gs} = 2V$ and $V_{ds} = 1V$, its $I_D$ = _____. | 01 |

| | | | |
|---|---|---|---|
| | 1.12 | An amplifier has its open loop and closed loop voltage gains as $46dB$ and $40dB$ respectively. The feedback factor is equal to _____%. | 01 |
| | 1.13 | In an $RC$ phase shift oscillator using an ideal voltage amplifier, the frequency of oscillations is $41kHz$. If $R = 5.6k\Omega$, the value of capacitor is _____. | 01 |
| | 1.14 | The slew rate of an op-amp is $6.28V/\mu sec$. If it is a voltage follower with an input of $100 \sin \omega t$, the maximum frequency of the input so that the output is not distorted = _____. | 01 |
| | 1.15 | The $CMRR$ of an op-amp is $92dB$, if its common mode gain = 0.5, its differential gain = _____ $dB$. | 01 |
| | 1.16 | In a Schmitt trigger circuit using an op-amp with power supply voltages of $+12V$ and $-12V$ and feedback factor of 0.3, the hysteresis voltage is equal to _____. | 01 |
| | 1.17 | The total power delivered by an $AM$ wave is $2640W$. If the modulation index = 0.8, the power in each sideband = _____. | 01 |
| | 1.18 | The output of an $AM$ transmitter is given by $V_{AM}(t) = 200(1 + 0.4 \sin 12560\ t) \sin 6.28 \times 10^6 t.$ The frequency of $USB$ is _____. | 01 |
| | 1.19 | In a frequency modulation scheme, $25MHz$ carrier is modulated by $400Hz$ audio sine wave, with a maximum deviation of $10kHz$. The modulation index is _____. | 01 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Write the logic expression for exclusive-$OR$ gate and realize it using minimum number of $NAND$ gates. | 04 |
| | b | Draw the truth table for "$SUM$" and "$CARRYOUT$" of a full adder. From the truth table, obtain the logic expression. From these expressions, realize the full adder using two half adders. | 06 |
| | c | Calculate the ac voltage in the circuit of Fig 2c.   Fig 2c | 06 |
| | | | |
| 3 | a | A full wave bridge rectifier without a filter capacitor is connected to a load resistance of $1.5k\Omega$. The input to the rectifier is $300 \sin 314t$, through a step down transformer. If the dc load current is $80mA$, calculate the turns ratio of the transformer. Assume all the diodes used are identical with a forward resistance of $50\Omega$. Also determine the load regulation. | 06 |

| | | | |
|---|---|---|---|
| | b | In a Zener regulator of Fig 3b, calculate the value of $R$, so that the circuit performs satisfactorily under all the given conditions. Given $I_{Zmin} = 6mA, P_{dmax} = 1164mW$.   Fig 3b | 06 |
| | c | Write a note on the three regions of operation of a bipolar transistor. | 04 |
| | | **OR** | |
| 4 | a | A full wave bridge rectifier drives a load resistance of 270Ω in parallel with a filter capacitor $C$. If the ac input to the rectifier is $150 \sin 628t$, calculate the capacitor value needed so that the ripple factor is 2%. Determine the output dc voltage, peak to peak ripple voltage and load regulation. | 06 |
| | b | Determine the operating point $(V_{CE}, I_C)$ of the silicon transistor in the circuit of Fig 4b. Also calculate the stabilization factor $S(I_{CO})$ for the circuit.   Fig 4b | 06 |
| | c | Explain the working principle and application of photodiode and $LEDs$. | 04 |
| | | | |
| 5 | a | In a common emitter amplifier of Fig 5a, find **re**, voltage gain, input and output impedance. The transistor used has a β = 99 and the dc emitter current =$2mA$.   Fig 5a | 06 |
| | b | List any four advantages of providing voltage series negative feedback to an amplifier. Prove that stability of the gain of $A_f$ of an amplifier with negative feedback improves by a factor of $(1 + A\beta)$ compared to that of the without feedback. | 06 |

| | | | |
|---|---|---|---|
| | c | An $NMOS$ transistor where $V_t = 1V$ and $K = 2mA/V^2$ is operating in saturation with a drain current of $4mA$. Determine $V_{gs}$ and calculate the trans-conductance $g_m$. | 04 |
| | | **OR** | |
| 6 | a | An amplifier requires an input of $15mV$ to produce a certain output. To get the same output with negative feedback, the required input signal is $330mV$. The closed loop voltage gain is $34dB$. Find open loop voltage gain of the amplifier and the feedback factor. | 06 |
| | b | An $n-$channel $MOSFET$ has a $V_t = 0.8V$ and $I_D = 0.75mA$ when $V_{gs} = V_{ds} = 2.5V$. Calculate:<br>i) Drain current, if $V_{gs} = 4.2V$ and $V_{ds} = 4.0V$<br>ii) Drain to source resistance $r_{ds}$ for small value of $V_{ds}$, if $V_{gs} = 4.8V$<br>iii) Gain $A_V$ if $V_{gs} = 4V$ and $R_d = 10k\Omega$. | 06 |
| | c | Draw the frequency response of an $RC$ coupled $CE$ amplifier and explain the effect of capacitor. | 04 |
| | | | |
| 7 | a | Write six important specifications of an op-amp. In the circuit of Fig 7a, determine the output voltage $V_o$.<br>  <br><br>Fig 7a | 06 |
| | b | Draw the circuit of a Schmitt trigger using an ideal op-amp and explain its function with suitable waveform. Calculate the values of resistors $R_1$ and $R_2$, given $V_{CC} = 12V$ and $V_H = 6V$. | 06 |
| | c | Draw the block diagram of data acquisition system and explain each block. | 04 |
| | | | |
| 8 | a | The output of an $AM$ transmitter is given by<br>$V_{AM}(t) = 50(1 + 0.6\cos 12560\,t)\sin 628 \times 10^4 t.$<br>Determine :<br>i) The sideband frequencies and their amplitudes<br>ii) Modulation index and bandwidth<br>iii) The minimum and maximum amplitudes of the AM wave<br>iv) The total power in the $AM$ wave, if the load resistance is $10\Omega$. | 08 |
| | b | Write eight differences between $AM$ and $FM$ systems. | 04 |
| | c | With a neat diagram, explain pulse code modulation system. | 04 |

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# RV COLLEGE OF ENGINEERING®

**(An Autonomous Institution affiliated to VTU)**

**I Semester B. E. Examinations April -2021**

## Common to All Branches

## ELEMENTS OF ELECTRONICS ENGINEERING

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

***Instructions to candidates:***

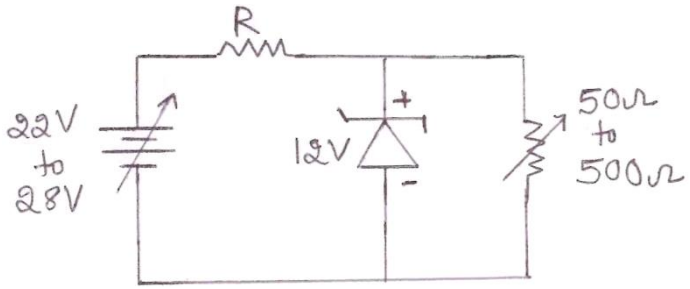
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

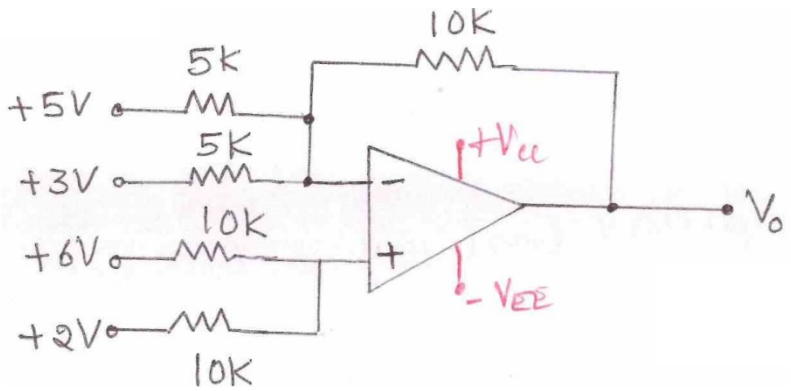
**PART-A**

| | | | |
|---|---|---|---|
| 1 | 1.1 | The forward voltage drop of a diode at $27^0C$ is $550mV$, the forward voltage drop at $57^0C$ is _____. | 01 |
| | 1.2 | The diffusion capacitance of a forward biased diode _____ with decrease in the forward current. | 01 |
| | 1.3 | The full wave bridge rectifier has dc load current $I_{dc} = 100mA$, input ac voltage is $220V, 50Hz$ and $C = 1000\mu F$. The peak to peak ripple voltage is _____. | 01 |
| | 1.4 | A dc power supply has a 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 |
| | 1.5 | 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 |
| | 1.6 | A ratio of $I_C/I_E$ is usually less than one and is defined for _____ configuration. | 01 |
| | 1.7 | The output of a cascaded chain of three amplifiers is $8V$, when the input voltage is $2\mu V$. If the voltage gain of first and third stages are $20dB$ and $40dB$ respectively, the voltage gain in the second stage is _____. | 02 |
| | 1.8 | An amplifier without feedback has a gain of 100 and a distortion of 8%. If 3% negative feedback is provided to the amplifier, the distortion is _____ %. | 01 |
| | 1.9 | An $n-$channel $MOSFET$ operating in saturation has $I_D = 4mA$ and $V_{0V} = 2V$. Its trans-conductance $(g_m)$ is _____. | 01 |
| | 1.10 | A $MOSFET$ uses the electric field of a _____ to control the channel current. | 01 |
| | 1.11 | A $1MHz$ sinusoidal carrier is amplitude modulated by a symmetrical wave of period $100\mu sec$. Calculate the upper side band frequency. | 01 |
| | 1.12 | Calculate the total modulation index if an $AM$ signal has modulation indices of 0.3 & 0.4. | 01 |
| | 1.13 | The minimized form of logic expression $\bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}BC + AB\bar{C}$ is _____. | 01 |
| | 1.14 | In a $3-$to$-8$ decoder, with $X_2X_1X_0$ as the inputs and $Y_0\ to\ Y_7$ as the outputs, what should be the input code so that $Y_6$ is high and all other outputs are low? | 01 |
| | 1.15 | The total number of gates required to implement $64:1$ multiplexer is _____. | 01 |

| | | | |
|---|---|---|---|
| | 1.16 | The minimum number of $NAND$ gates required to realize $XOR$ gates is _____. | 01 |
| | 1.17 | The output signal of an op-amp with a slew rate of $2.5V/\mu sec$ has a peak to peak value of $18V$. Find the maximum frequency of undistorted output signal. | 01 |
| | 1.18 | An op-amp has a differential gain of $86dB$ and common mode gain of $20dB$. The $CMRR$ in $dB$ is _____. | 01 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | List any four specifications of a PN junction diode and indicate their typical values. | 04 |
| | b | 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 $220\Omega$ in parallel with a capacitor filter $C$. Calculate the value of $C$ required so that the ripple factor is 3%. Also determine:<br>i) The dc output voltage<br>ii) The peak to peak voltage<br>iii) The load regulation. | 06 |
| | c | In a Zener regulation circuit of Fig 2c, design the value of $R$, so that circuit performs satisfactorily under all the given conditions. Given $P_{d(max)} = 6W, I_{Zmin} = 10mA, V_Z = 12V$.<br>  <br><br>Fig 2c | 06 |
| | | | |
| 3 | a | Explain the different operating regions of a transistor along with the applications and draw the output characteristics for transistor in common emitter configuration. | 04 |
| | b | In a $RC$ coupled $CE$ amplifier, $R_1 = 120k\Omega$, $R_2 = 40k\Omega$, $R_E = 1.5k\Omega$, $R_C = R_L = 2.7k\Omega$, $V_{CC} = 12V$ and $\beta = 99$. Determine the operating point of a silicon transistor and also calculate the voltage gain. | 06 |
| | c | Mention any six advantages of negative feedback. Prove that the stability of the gain of an amplifier with negative feedback is $(1 + A\beta)$ times better compared to that of the amplifier without feedback. | 06 |
| | | **OR** | |
| 4 | a | Explain the following:<br>i) Thermal runaway<br>ii) Early effect. | 04 |
| | b | A voltage amplifier needs $2mV$ input to give a $10V$ output. When negative feedback is provided to this amplifier, it needs $200mV$ to deliver the same output. Determine the open loop gain, closed loop gain, feedback factor and amount of feedback in $dB$ for this amplifier. | 06 |
| | c | Explain the working of $RC$ coupled amplifier with the circuit diagram. Draw its frequency response and briefly explain three regions. | 06 |
| | | | |

| | | | |
|---|---|---|---|
| 5 | a | Draw the circuit diagram and explain the operation of a two input $CMOS\ NOR$ gate. | 04 |
| | b | An $n-$channel $MOSFET$ has $V_t = 0.9V$. If $V_{gs} = V_{ds} = 2.5V$, the drain current $I_D$ is $0.75mA$,<br>i) Find $I_D$, if $V_{gs} = 4.1V$ and $V_{ds} = 4V$<br>ii) Find the trans-conductance $g_m$, if $V_{gs} = 3.4V$<br>iii) Find $r_{ds}$ for small value of $V_{ds}$ if $V_{gs} = 4.9V$. | 06 |
| | c | Draw the block diagram of a communication system and explain the function of each block. List the need for modulation (any four). | 06 |
| | | **OR** | |
| 6 | a | List eight differences between amplitude modulation and frequency modulation. | 04 |
| | b | Explain the operation of a $n-$channel enhancement $MOSFET$ with a suitable diagram along with its output characteristics. | 06 |
| | c | An amplitude modulated wave with a modulation index of 50% produces sideband frequencies of $8.824MHz$ and $8.854MHz$. The amplitude of each sideband is $50V$. Determine the amplitude and frequency of both carrier and modulating signals. | 06 |
| | | | |
| 7 | a | Starting from the logic expression, realize $XNOR$ gate using minimum number of $NAND$ gates. | 04 |
| | b | Simplify the logic expression using $K-$map and implement the logic circuit using basic gates.<br>$$f(a,b,c,d) = \sum m(0,1,2,3,4,6,8,9,10,11,12,14)$$ | 06 |
| | c | Explain the operation of a $1-to-4$ demultiplexer and write the logic expressions for its outputs. Also draw the logic circuit to realize the demultiplexer. | 06 |
| | | | |
| 8 | a | Draw the circuit of an integrator using an op-amp. Derive the expression for the output voltage. | 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 $V_o = V_1 - 2V_2 - 4V_3 + 6V_4 + 8V_5$ where $V_1, V_2, V_3, V_4$ and $V_5$ are the available input voltages. | 06 |
| | c | Calculate the output voltage $V_o$ for the circuit shown in Fig 8c.<br>  <br><br>Fig 8c | 06 |

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# RV COLLEGE OF ENGINEERING®

**(An Autonomous Institution affiliated to VTU)**

**I / II Semester B. E. Fast Track Examinations Oct-2020**

## Common to All Branches

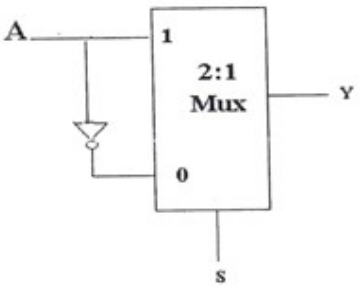
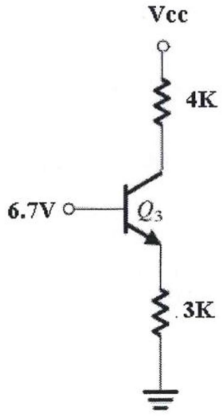
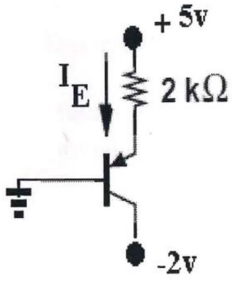
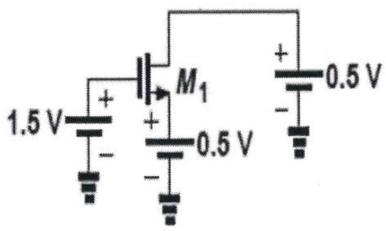
## BASICS OF ELECTRONICS ENGINEERING

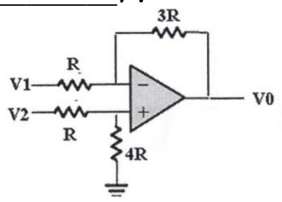
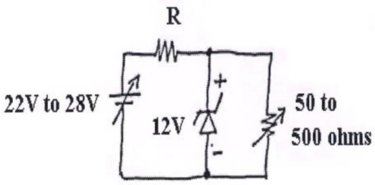
***Time: 03 Hours*** ***Maximum Marks: 100***

***Instructions to candidates:***

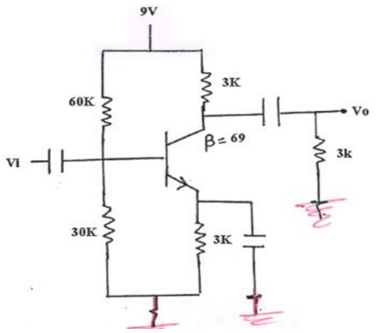
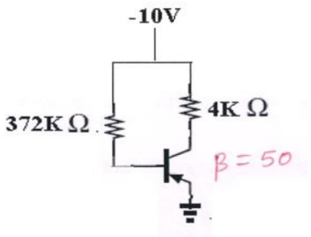
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

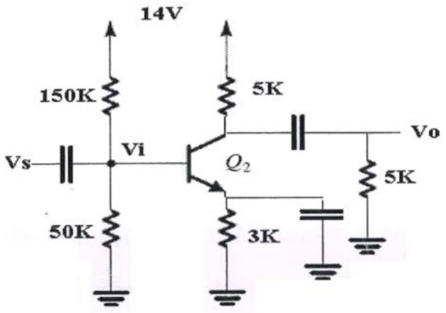
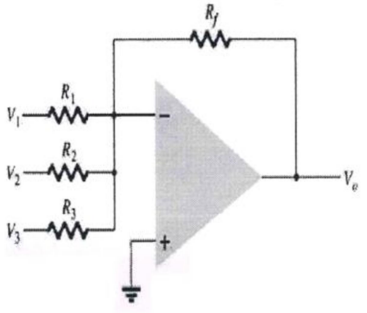
### PART-A

| | | | |
|---|---|---|---|
| 1 | 1.1 | Simplify the following Boolean expression $T(T+U) =$ _____. | 01 |
| | 1.2 | Minimum number of $NOR$ gates required to realize a 2 input $EXOR$ gate, using only $NOR$ gates = _____. | 01 |
| | 1.3 | The circuit shown in Fig 1.3 represents _____ gate.   Fig 1.3 | 01 |
| | 1.4 | The number of select lines required to realize a 1:512 demux is _____. | 01 |
| | 1.5 | _____ is a circuit which converts ac input signal to pulsating $DC$ output signal. | 01 |
| | 1.6 | If the input of a full wave bridge rectifier is $100 \sin \omega t$, then the $PIV$ rating of the diode used should be atleast = _____. | 01 |
| | 1.7 | Zener breakdown occurs due to _____. | 01 |
| | 1.8 | If the $Si$ transistor shown in Figure 1.8 has very large $\beta$, then $V_{CC} = V$; take $V_{CE} = 2V$.       | |

| | | | |
|---|---|---|---|
| | 1.9 | Emitter current in the circuit of Fig 1.9 is = _____. | 01 |
| | 1.10 | The lower cutoff frequency of a $RC$ coupled amplifier is $400Hz$ and the corresponding gain is 80. If the bandwidth required is $30\,KHz$, upper cutoff frequency = _____. | 01 |
| | 1.11 | The $M1$ transistor in the circuit shown in Fig 1.11 has $V_t = 0.5\,V$. The region of operation of $M1$ = _____. | 01 |
| | 1.12 | In common base configuration, phase difference between input and output= _____. | 01 |
| | 1.13 | For the circuit shown in Fig 1.13, If $V1 = 2V$ and $V2 = 5V$, then output voltage = _____$V$.   Fig 1.13   Fig 3b | 02 |
| | 1.14 | An opamp has a differential gain of $100dB$ and $CMRR$ of $80dB$. If the differential input is $100\mu V$ and common mode input is $100mV$, output voltage = _____. | 02 |
| | 1.15 | An amplifier modulated wave will have _____ number of sidebands. | 01 |
| | 1.16 | Maximum efficiency of an $AM$ wave = _____%. | 01 |
| | 1.17 | In a $FM$ wave, the frequency of the carrier is varied in accordance with _____ of the message signal. | 01 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Explain the operation of a $4:1$ multiplexer and write the logic expression for its output. Also draw the logic circuit to realize that expression. | 06 |
| | b | Prove that the dynamic resistance of a $PN$ junction diode depends on Thermal voltage and Diode forward current. Draw the $V-I$ characteristic of a $PN$ junction diode indicating the different parameters. Show the effect of temperature on the characteristic. | 06 |
| | c | Prove the following postulates of Boolean logic:<br>i) $A + \bar{A}\,B = A + B$ ii) $(A + B)(A + C) = A + BC$ | 04 |
| | | | |
| 3 | a | Explain Thermal runaway and Bias stabilization related to Bipolar Junction Transistors ($BJT$). | 04 |
| | b | In the voltage regulator circuit shown in Fig 3b, design the value of $R$, so that the circuit performs satisfactorily for the given input voltage and load variations. For the zener, $I_{Zmin} = 10mA$ and $P_{dmax} = 6W$. | 06 |
| | c | In the voltage amplifier circuit shown in Fig 3c, find the following:<br>i) Operating ($Q$) point of the transistor<br>ii) Stability factor $S_{(ICO)}$.     | |

| | | | |
|---|---|---|---|
| | | **OR** | |
| 4 | a | With a neat block diagram, explain different stages of $DC$ power supply. | 06 |
| | b | $220V$, $50Hz$ ac supply is connected to a full wave bridge rectifier, without a filter, through $10:1$ transformer. The forward resistance of each diode used is $6\Omega$ and the load resistance is $80\Omega$. Find<br>i) dc load current<br>ii) dc output voltage<br>iii) $RMS$ load current<br>iv) Rectification efficiency<br>v) Load regulation<br>vi) Ripple factor. | 06 |
| | c | Find the operating point for the circuit shown in Figure 4c. | 04 |
| | | | |
| 5 | a | Draw the circuit of 2 –input $CMOS\ NAND$ gate and explain its working. | 04 |
| | b | A n-channel $MOSFET$ has $V_t = 0.8\,V$ and drain current of $0.75mA$ when $V_{GS} = V_{DS} = 2.5\,V$. Find:<br>i) drain current if $V_{GS} = 4.2V\ and\ V_{DS} = 4V$<br>ii) $r_{ds}$ if $V_{GS} = 4.8V$ assuming $V_{DS}$ to be very small.<br>iii) Transconductance if $V_{GS} = 3.5V$. | 06 |
| | c | Explain Barkhausen criteria for sustained oscillations. Explain any five advantages providing negative feedback to amplifiers. | 06 |
| | | **OR** | |
| 6 | a | Find $V_o/V_i$, input impedance and output impedance for the circuit shown in Figure 6a. Assume $\beta = 50$ and $I_E = 0.5mA$.<br>  <br><br>Fig 6a<br>  <br><br>Fig 7b | 04 |
| | b | Draw the circuit of $RC$ phase shift oscillator and find the frequency of oscillations if the output resistance of the common emitter amplifier is $3.3K\Omega$. The phase shift network uses $2.2K\Omega$ resistors and $25nF$ capacitors. | 06 |
| | c | With a neat diagram, explain the structure and working of N-channel enhancement type $MOSFET$. Draw the plot of $I_D\ versus\ V_{GS}$ and $I_D\ versus\ V_{DS}$. | 06 |
| | | | |
| 7 | a | Draw the circuit of a Schmitt trigger and explain its operation with necessary waveforms. | 06 |
| | b | Explain how an Opamp can be used as a summer. If $V1 = -2V$, $V2 = -3V$, $V3 = 4V$ and $R1 = 10K\Omega$, $R2 = 20K\Omega$, $R3 = 30K\Omega$, $Rf = 10K\Omega$, find $V_0$ of Opamp summer shown in Fig 7b. | 04 |
| | c | Draw the summer circuit using two ideal op amps and calculate the different resistor values to obtain $V_O = 4V_1 - 7V_2 + 6V_3 - 7V_4$ where | |

| | | | |
|---|---|---|---|
| 8 | a | List eight differences between $AM$ and $FM$. | 04 |
| | b | Draw the block diagram of a communication system and explain the function of each block. List the need for modulation (any four). | 04 |
| | c | Draw the block diagram of a digital signal processor and explain the function of each block. | 04 |
| | d | A $93.2MHz$ carrier is frequency modulated by a $5KHz$ sinusoidal signal. The resultant $FM$ signal has a frequency deviation of $40KHz$. What are the highest and lowest frequencies in the frequency modulated signal? Also, calculate the modulation index. | 04 |

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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.

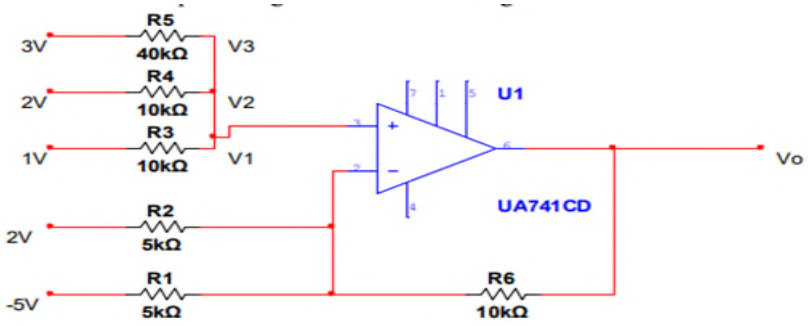
### PART-A

| | | | |
|---|---|---|---|
| 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 $\beta$ 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:<br>i) Drain current, if $V_{GS} = 4.1V$ and $V_{DS} = 4.0V$.<br>ii) Drain to source resistance $r_{ds}$ for small values of $V_{DS}$, if $V_{GS} = 4.9V$<br>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 |

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# R. V. COLLEGE OF ENGINEERING

**Autonomous Institution affiliated to VTU**

**I Semester B. E. Examinations Nov/Dec-18**

## Common to All Branches

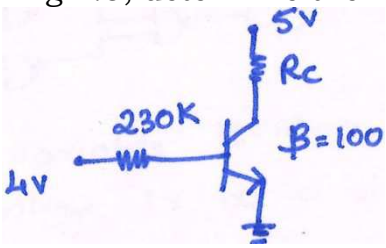
## ELEMENTS OF ELECTRONICS ENGINEERING

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

***Instructions to candidates:***

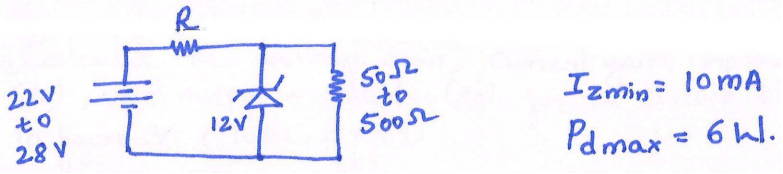
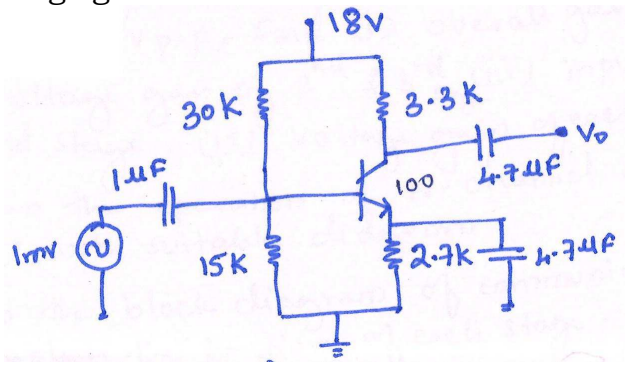
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

### PART-A

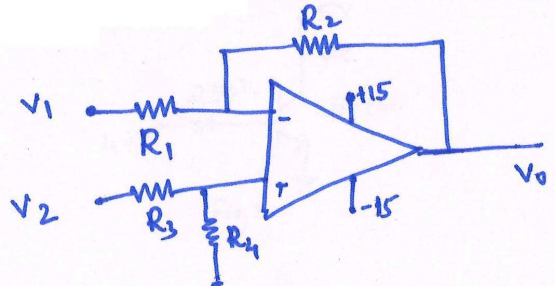
| | | | |
|---|---|---|---|
| 1 | 1.1 | The maximum frequency at which a $PN$ junction diode could be used as a switch is limited by its _____. | 01 |
| | 1.2 | For small signal ac operation, a practical forward biased diode can be modeled as _____. | 01 |
| | 1.3 | The input to a full wave bridge rectifier with a capacitor filter is $200V, 50Hz$ supply. If the load resistance is $1K\Omega$, calculate the minimum value of filter capacitor required to keep the ripple factor below 2%. | 01 |
| | 1.4 | For an $NPN$ transistor, if $I_{CO}$ is $4\mu A$, $I_B = 0, V_{CE} = 4V$ and $I_C = 100\mu A$, then the value of $\beta$ is _____. | 01 |
| | 1.5 | In the inverter circuit of fig 1.5, determine the minimum value of $R_C$.   Fig 1.5 | 01 |
| | 1.6 | In a $BJT$, if the forward voltage $V_{BE}$ is maintained constant, the base current _____ with increase in the reverse bias voltage across $CB$ junction. | 01 |
| | 1.7 | The bandwidth of an amplifier with negative feedback increases by a factor of _____. | 01 |
| | 1.8 | An $NMOS$ transistor with $V_t = 1V$ is biased such that $V_S = 2V$ and $V_G = 5V$. The maximum value of $V_D$ allowed so that transistor operates in ohmic region = _____. | 01 |
| | 1.9 | A $MOSFET$ is a _____ controlled device. | 01 |
| | 1.10 | A carrier signal of $20V$ amplitude is modulated by two sinusoidal modulating signals of amplitudes $6V$ and $8V$. The effective modulation index is _____. | 01 |
| | 1.11 | Three amplifiers with voltage gains $10, 200$ and $400$ are connected in cascade. Find the overall voltage gain in decibels. | 01 |
| | 1.12 | In a comparator using an ideal op-amp, if the input voltage is $5\,sin\omega t$ and the reference voltage is zero, the output waveform is _____. | 01 |

| | | | |
|---|---|---|---|
| | 1.13 | The differential gain of an op-amp is $94dB$ and the common mode gain is 2. Then $CMRR$ in $dB$ is _____. | 01 |
| | 1.14 | If an op-amp with an open loop gain of 499 is used as a voltage follower, the error in the gain from its ideal value = _____. | 01 |
| | 1.15 | In an n-variable $K$-map, combining 8-adjacent cells containing 1's as a single group will eliminate _____ variables. | 01 |
| | 1.16 | Simplify the following expression $y = \overline{\overline{AB} + \overline{A} + AB}$. | 02 |
| | 1.17 | An ideal op-amp is an ideal _____ controlled _____ source. | 01 |
| | 1.18 | Avalanche breakdown in a semiconductor diode occurs due to _____. | 01 |
| | 1.19 | The two inputs to an $XNOR$ gate are $A$ and $\overline{A}$ . The output is _____. | 01 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Draw the circuit diagram of a full wave bridge rectifier with capacitor filter along with input and output waveforms. The rectifier drives a load resistance in parallel with a capacitor. Given the ripple factor is equal to 1.5% and the ac input to the rectifier is $150V$ at $100Hz$, calculate the output $DC$ voltage, peak to peak ripple voltage and load regulation. | 06 |
| | b | In a Zener regulator of fig 2b, calculate the value of $R$, so that the circuit performs satisfactorily under all the given conditions.   Fig 2b | 06 |
| | c | Draw the $VI$ characteristics of a $PN$ junction diode at two different temperatures and explain the changes in the characteristics with temperature. | 04 |
| | | | |
| 3 | a | With respect to $BJTs$, explain the following:<br>i) Bias stabilization<br>ii) Thermal runaway<br>iii) Early effect. | 06 |
| | b | Determine the operating point of the silicon transistor in fig 3b. Also calculate the voltage gain.   Fig 3b | 06 |
| | c | Prove that the gain stability of an amplifier with negative feedback improves by a factor of $(1 + A\beta)$ compared to that of the amplifier without feedback, where $A$ is the open loop gain and $\beta$ is the feedback factor. | 04 |
| | | **OR** | |

| | | | |
|---|---|---|---|
| 4 | a | Briefly explain the three regions of operation of a $BJT$. Draw and explain the input and output characteristics of a $BJT$. | 06 |
| | b | An amplifier in the open loop has a gain of $80\,dB$, bandwidth of $300\,KHz$, distortion of 10%, input impedance of $20K\Omega$ and output impedance of $2K\Omega$. If 2% voltage series negative feedback is given to this amplifier, calculate the gain, BW, input & output impedances and distortion of the closed loop amplifier. | 05 |
| | c | Three amplifier stages are cascaded with $0.05V_{P-P}$ input providing $150V_{P-P}$ output. If the voltage gain of first stage is 20 and the input to the third stage is $15V_{P-P}$, find:<br>i) Overall gain in dB<br>ii) Voltage gains of $2^{nd}$ and $3^{rd}$ stages<br>iii) Input voltage to the second stage<br>iv) Voltage gain of each stage in dB. | 05 |
| | | | |
| 5 | a | Explain the operation of an N-channel enhancement $MOSFET$ with a suitable diagram along with its output characteristics. | 06 |
| | b | Draw the block diagram of communication system and explain the function of each of the blocks. | 05 |
| | c | A carrier of $1MHz$ with $1KW$ power is amplitude modulated with a sinusoidal signal of $2KHz$. The depth of modulation is 60%. Calculate the sideband frequencies, bandwidth, power in each sideband and the total power in the modulated wave. | 05 |
| | | **OR** | |
| 6 | a | Draw the circuit diagram and explain the operation of a two input $CMOS\ NOR$ gate. | 06 |
| | b | An $N$-channel $MOSFET$ has a threshold voltage $V_t = 0.8V$ and $I_D = 0.75mA$, when $V_{GS} = V_{DS} = 2.5V$. Calculate:<br>i) Drain current, if $V_{GS} = 4.2V$ and $V_{DS} = 4.0V$.<br>ii) Drain to source resistance $r_{DS}$ for small values of $V_{DS}$, if $V_{GS} = 4.8V$.<br>iii) Trans conductance $g_m$, if $V_{GS} = 4.8V$. | 06 |
| | c | List out eight differences between $AM$ and $FM$ systems. | 04 |
| | | | |
| 7 | a | Simplify the following expression using 4-variable $K$-map:<br>$f(a,b,c,d) = \sum(1,3,4,5,7,8,9,11,15)$ | 05 |
| | b | Explain the operation of an $8:3$ encoder with necessary truth table, logic expression and logic circuit. | 05 |
| | c | Write the truth table for the sum and carry out of a full adder. From the truth table, obtain the logic expressions. From the logic expressions, realize the logic circuit using $NAND$ gates only. | 06 |
| | | | |
| 8 | a | List atleast eight characteristics of an ideal op-amp and indicate their typical values for a practical op-amp. | 04 |
| | b | Draw the circuit of a summer, using two ideal op-amps and design the different resistance values to obtain an output $V_0 = V_1 + 3V_2 + 5V_3 - 7V_4 - 9V_5$, where $+V_1, +V_2, +V_3, +V_4$ and $+V_5$ are the only available inputs. | 06 |

| | | |
|---|---|---|
| c | In the circuit of fig 8c, show that the differential gain is equal to $R_2/R_1$, if $R_1/R_2 = R_3/R_4$. Assume the op-amp used is ideal.<br>  <br><br>Fig 8c | 06 |

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# R. V. COLLEGE OF ENGINEERING

**Autonomous Institution affiliated to VTU**

**I Semester B. E. Examinations Nov/Dec-18**

## Common to All Branches

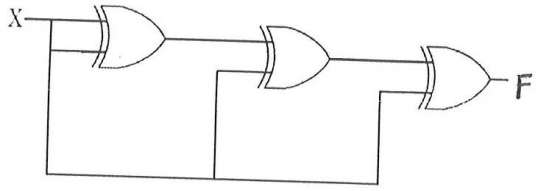
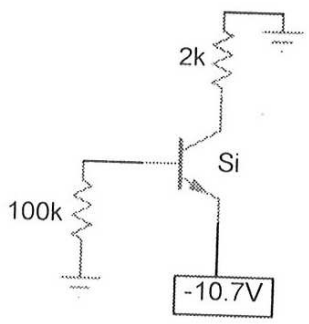
## BASICS OF ELECTRONICS ENGINEERING

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

***Instructions to candidates:***

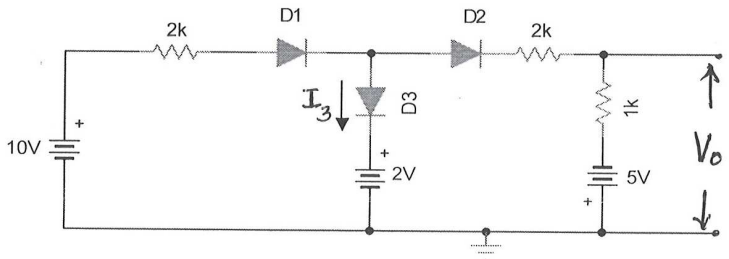
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

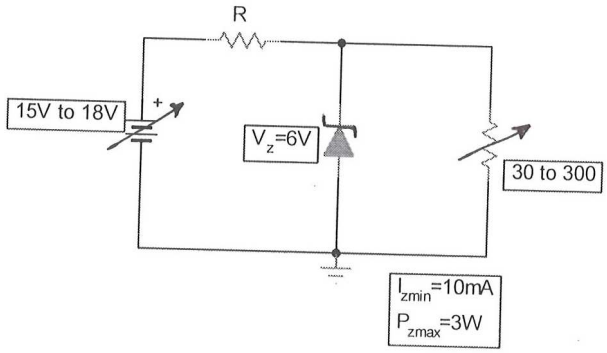
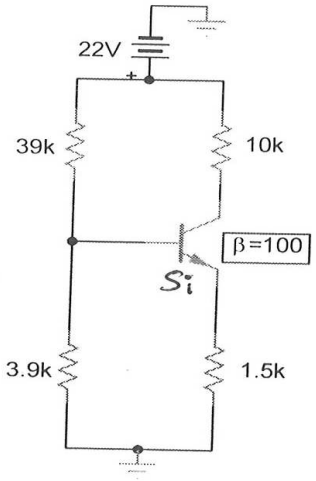
### PART-A

| | | | |
|---|---|---|---|
| 1 | 1.1 | What are the minimum number of 2-to-1 multiplexers required to generate a 2-input $AND$ gate. | 01 |
| | 1.2 | The Boolean function $Y = AB + CD$ is to be realized using only 2 input $NAND$ gates. The minimum number of gates required is _____. | 01 |
| | 1.3 | For the circuit of fig 1.3, the output $F$ is given by   Fig 1.3 | 01 |
| | 1.4 | A $S_i$ diode has its maximum power dissipation as $3W$ at 27℃ with a de-rating factor of $20\,mW/$℃. Determine the power dissipation of the diode at 37℃. | 01 |
| | 1.5 | If a full wave bridge rectifier uses a capacitor filter with $C = 1000\mu F$ and $R_L = 1k\Omega, f = 100Hz$ , then the ripple factor is _____. | 01 |
| | 1.6 | In a full wave rectifier, without any filter, using diodes with a forward resistance of $10\Omega$ each, the load resistance is equal to $20K\Omega$ . The % load regulation of the rectifier= _____. | 01 |
| | 1.7 | A bipolar junction transistor has its $I_C = 2mA$ and $\beta = 199$, if $I_B = 0$, its $I_{C0}$ = _____. | 01 |
| | 1.8 | For the circuit of fig 1.8, $\beta = 30$. The value of $I_C$ = _____.   Fig 1.8 | 01 |

| | | | |
|---|---|---|---|
| | 1.9 | The lower cut off frequency of an $RC$ coupled amplifier is $500Hz$, it has a voltage gain of 50 at $500Hz$ and has a bandwidth of $50KHz$. The upper cut off frequency = _____. | 01 |
| | 1.10 | Three voltage amplifiers are cascaded to provide an overall gain of 10000. The first and the last stages have gains of $16dB$ and $22dB$, then the gain of the middle stage is _____. | 01 |
| | 1.11 | For an $N$-channel $MOSFET$, threshold voltage $V_t = 1V$. The device is biased such that $V_S = 3V$, $V_G = 6V$ and $V_D = 4V$. The device is operating in _____ region. | 01 |
| | 1.12 | An open loop amplifier gain is 1000 and 2.9% negative feedback is provided to this amplifier. The gain of the open loop amplifier changes by 15% due to temperature variations. The change in gain with feedback is = _____. | 01 |
| | 1.13 | The slew rate of an op amp is $2V/\mu s$. If it is used as a voltage follower with an input signal of $5sin\omega t$, the maximum frequency of the input so that the output is not distorted= _____. | 01 |
| | 1.14 | An op-amp has a common mode gain of 10 and a $CMRR$ of $100dB$. If the differential input is $10\mu V$ and common mode voltage is $1mV$, the output voltage is = _____. | 01 |
| | 1.15 | In a voltage follower circuit, the op-amp used is ideal in all respects except that it has a finite gain of 100. The gain of the voltage follower is = _____ | 01 |
| | 1.16 | A Schmitt trigger circuit with an op-amp is connected to a power supply voltages $+15V$ and $-12V$ and has a feedback factor $\beta = 0.3$. The value of resistors in a Schmitt trigger circuit, $R_1$= _____ and $R_2$= _____. | 01 |
| | 1.17 | The current drawn by the antenna of an $AM$ transmitter is $5A$ when only carrier is present and this increases to $6A$ when the carrier is modulated by a sine wave. The percentage modulation is =_____. | 01 |
| | 1.18 | $AM$ signal and $FM$ signal frequency ranges are _____ and _____ respectively. | 01 |
| | 1.19 | Given an $FM$ wave, $V_{FM} = 10Sin[2\pi \times 10^8 t + 5Sin(2\pi \times 15 \times 10^3 t)]$, the bandwidth is = _____. | 01 |
| | 1.20 | Mention two advantages of digital communication over analog communication. | 01 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Write the logic expression for $EX-NOR$ function and realize it using minimum number of $NOR$ gates only. | 04 |
| | b | Explain the operation of 8 to 3 encoder. Write the logic expressions for the outputs and realize it using basic gates. | 06 |
| | c | Determine the current $I_3$ through the diode $D_3$ and the output voltage $V_o$ in the circuit of fig 2c. All the diodes are silicon diodes.   Fig 2c | 06 |
| | | | |

| | | | |
|---|---|---|---|
| 3 | a | A full wave bridge rectifier using ideal diodes is supplied from a secondary of a 10:1 transformer whose primary is connected to $240V, 50Hz$ main supply. The output of the rectifier is connected to a resistance of 1000Ω, in parallel with a capacitor filter $C$. Calculate:<br>i) The value of '$C$' required so that the ripple factor is 1%<br>ii) $DC$ output voltage<br>iii) Peak-peak ripple voltage<br>iv) Load regulation. | 04 |
| | b | In a Zener circuit of fig 3b, design the value of '$R$' so that the regulator performs satisfactorily for all the given input voltage and load conditions. Load resistance varies from 30Ω to 300Ω.<br>  <br><br>Fig 3b | 06 |
| | c | For the voltage divider bias circuit of fig 3c, find the operating point.<br>  <br><br>Fig 3c | 06 |
| | | **OR** | |
| 4 | a | Draw the circuit of a full wave bridge rectifier along with input and output waveforms. Explain the principle of operation. Derive the expression for efficiency of a practical full wave bridge rectifier. | 04 |
| | b | Explain the principle of operation of $LED$ and photodiode. Mention their typical applications. | 04 |
| | c | Determine the values of $R_C, R_1$ and $R_2$ for the voltage divider bias network with a silicon transistor given the following DC operating conditions. $V_{CC} = 20V, VCE_Q = 8V, IC_Q = 10mA, S(I_{CO}) = 3, R_E = 200\Omega$ and $\beta = 80$. | 08 |
| | | | |
| 5 | a | Draw the circuit of an $RC$ coupled amplifier in common emitter configuration. Explain the principle of operation by drawing the frequency response. | 06 |

| | | | |
|---|---|---|---|
| | b | An amplifier has a voltage gain of $40dB$, bandwidth of $600KHz$, input impedance of $15K\Omega$, distortion of 10% and an output impedance of $2K\Omega$. If voltage series negative feedback of 1.9% is given to this amplifier, calculate the gain, input impedance, output impedance, bandwidth and distortion of the amplifier with negative feedback. Also find the amount of feedback in $dB$. | 06 |
| | c | An N-channel enhancement type $MOSFET$ with $V_t = 1V$ conducts a current $I_D = 100\mu A$ when $V_{GS} = V_{DS} = 1.5V$. Find the value of $I_D$ for $V_{GS} = V_{DS} = 2.5V$. Also calculate the value of $r_{DS}$ for small values of $V_{DS}$ , when $V_{GS} = 3V$. | 04 |
| | | **OR** | |
| 6 | a | Draw the circuit and explain the operation of an $RC$ phase shift oscillator using a common emitter amplifier. Determine the frequency of oscillation, if the output resistance of the common emitter amplifier is $3K\Omega$, the phase shift network uses $1.5K\Omega$ resistors and $10nF$ capacitors. | 07 |
| | b | Draw the circuit of a $CMOS$ Inverter. With the truth table, explain the operation of the circuit. | 04 |
| | c | Draw the ac equivalent circuit of a $CE$ configuration. Give a comparison of the three configurations in which a $BJT$ could be used as an amplifier. | 05 |
| | | | |
| 7 | a | Draw the summer circuit, using two ideal op amps, and calculate the different resistor values to obtain an output voltage of $V_0 = V_1 - 4V_2 + 5V_3 - 8V_4$. | 05 |
| | b | Draw the circuit of an Instrumentation amplifier, using three ideal amplifiers, and calculate the values of the different resistors to obtain a differential gain of $80dB$ with an infinite $CMRR$. | 06 |
| | c | Explain the principle of operation of data converters. | 05 |
| | | | |
| 8 | a | Write eight differences between $AM$ and $FM$ systems. | 06 |
| | b | A carrier wave with amplitude $10V$ and frequency $10MHz$ is amplitude modulated to 70% level with a modulating frequency $2KHz$, write the equation of $AM$ signal and sketch the frequency spectrum. | 04 |
| | c | Draw the block diagram of a digital signal processor and explain function of each block. | 06 |