T . L

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P.O. BOX 2707 KIGALI Tel : (+250) 255113365
E-mail : examinations@wda.gov.rw
Website : www.wda.gov.rw

Code ....T.048......Team.....T.C.E.L.......

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ANSWER BOOKLET

Option ......Computer Electronics........

Subject ......General Electronics........

Academic Year 2013

Marking scheme

INSTRUCTIONS

1. Write your answers on the 16 lined pages
2. Use the last non-lined pages as draft

FOR EXAMINER'S USE ONLY

QUESTIONS	1	2	3	4	5	6	7	8	9	10	Total
Marks											

QUESTIONS	11	12	13	14	15	16	17	18	19	20	Total
Marks											

QUESTIONS	21	22	23	24	25	26	27	28	29	30	Total
Marks											

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SECTION I

Q1 a) Crossover distortion: produces a zero voltage "flat spot" or "dead band" on the output wave shape as it crosses over from one half of the waveform to the other.

or

Is a result of one transistor cutting before other begins conducting.

b) threshold voltage is the voltage to which a semiconductor diode starts to conduct a current in forward direction. This voltage is 0.7 V for Silicon (Si) and 0.3V for Germanium (Ge)

c) Pinchoff; refers to the phenomena occurs when the gate voltage ($-V_{GS}$) is made more negative, the width of the channel decreases until no more current flows between the drain and the source ($V_{ds} >> V_p$) it is (similar to the cut-off region for a BJT)

Q.2) Differentiate Depletion type and Enhancement type of field effect Transistor

Depletion type	Enhancement type
* The transistor requires a Gate source voltage (V_{GS}) to switch the device off. 1	* the transistor requires a Gate source voltage (V_{GS}) to switch the device ON. 1
* the depletion mode MOSFET is equivalent to a "normally closed" 1	* the depletion mode MOSFET is equivalent to a "normally open". 1
* It can work in two modes (D and E) 1	* It can only work only in one mode (E mode) 1

Choose only 2 points

12/11

4 mark

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Q3) Given R_1 and R_2
When connected in series $R_T = 18\,\Omega$
When connected in parallel $R_T = 4\,\Omega$

$R_1 + R_2 = 18$ ✓ Let R_1 be x and R_2 be y

$\frac{R_1 R_2}{R_1 + R_2} = 4$ 0.1

$\begin{cases} x + y = 18 \\ 4x + 4y = xy \end{cases}$ 0.1 ✓

$4x + 4(18 - x) = x(18 - x)$ 0.1 ✓
$4x + 72 - 4x = 18 - x^2$ 0.1 ✓
$72 = 18x - x^2 \Rightarrow x^2 - 18x + 72$

$\Delta = b^2 - 4ac \Rightarrow R_1, R_2 = \frac{-b \pm \sqrt{\Delta}}{2a}$ 0.1 ✓

$R_1 = \frac{-(-18) + 6}{2} = 12\,\Omega$ 0.1 ✓

$R_2 = \frac{-(-18) - 6}{2} = 6\,\Omega$ 0.1 ✓

Hence if R_1 is $12\,\Omega \Rightarrow R_2 = 6\,\Omega$
if $R_1 = 6\,\Omega \Rightarrow R_2 = 12\,\Omega$ 0.1 ✓

4mi

Q4). $I_E = I_B + I_C$
$\beta = \frac{I_C}{I_B}$ and $\alpha = \frac{I_C}{I_E}$ 0.1 ✓, $I_B = I_E - I_C$ 0.1
$I_E = I_B + I_C$ 0.1

$\frac{I_E}{I_C} = \frac{I_B}{I_C} + \frac{I_C}{I_C} \Rightarrow \frac{1}{\alpha} = \frac{1}{\beta} + 1$

$\Rightarrow \frac{1}{\alpha} = \frac{1+\beta}{\beta} \Rightarrow \alpha = \frac{\beta}{1+\beta}$

$\alpha = \frac{I_C / I_B}{\frac{I_B}{I_B} + \frac{I_C}{I_B}}$ 0.1 ✓ $\Rightarrow$ $\boxed{\alpha = \frac{\beta}{1+\beta}}$ or $\boxed{\beta = \frac{\alpha}{1-\alpha}}$

1 1

$\beta = \frac{I_C / I_E}{\frac{I_E}{I_E} - \frac{I_C}{I_E}}$ 0.1 ✓

3mi

Q5) Differentiate between a BJT and FET

BJT	FET
1. Bipolar (uses electrons and holes) 0.1	Unipolar (uses electrons or holes) 0.1
2. Current controlled device 0.1	Voltage controlled device 0.1
3. Low input resistance 0.1	High input resistance 0.1
4. Low switch speed 0.1	High switch speed 0.1
5. More noise 0.1	Less noise 0.1
6. Manufacture is difficult 0.1	Manufacture is not difficult 0.1

Choose only 3 point

3m

Q6) $A_v = \frac{\text{output voltage}}{\text{input voltage}} = \frac{1}{0.01} = 100$ 0.1

$A_i = \frac{\text{output current}}{\text{Input current}} = \frac{10}{1} = 10$ 0.1

$A_p = A_v \times A_i = 100 \times 10 = 1000$ 0.1

$A_V(dB) = 20\log 100 = 40dB$ 0.1

$A_i(dB) = 20\log 10 = 20dB$ 0.1

$A_p(dB) = 10\log 1000 = 30dB$ 0.1

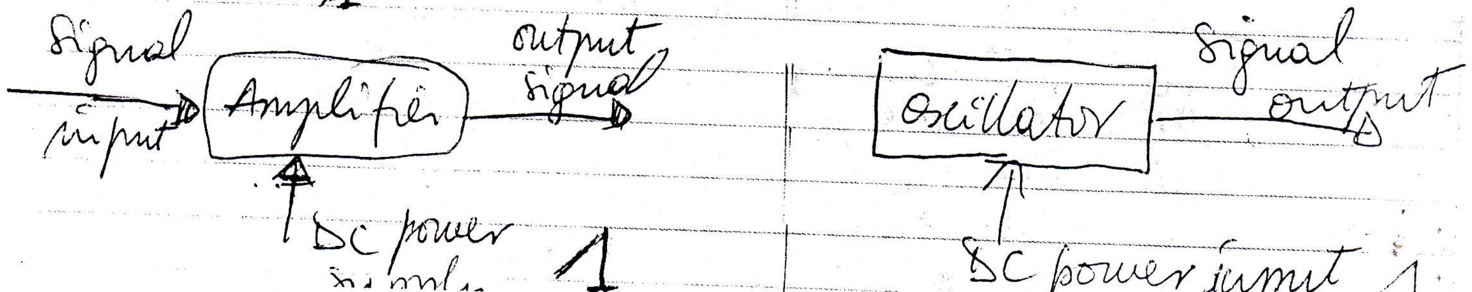
3m

Q7) Differentiate the oscillator and amplifier

An amplifier produces an output signal whose waveform is similar to the input signal but whose power level is generally high. 1

An oscillator may be defined in any one of the following two ways:

* It is a circuit which converts dc energy into ac energy at a very high frequency 1
* It is an electronic source of alternating current or voltage having sine, square or sawtooth or pulse shapes. 1



1 1

Q8: The conditions to turn on the BJT are:
- Base-Emitter junction must be forward biased 1
- The Base-collector junction must be reverse biased 1

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Q9 a) Phototransistor is light sensitive transistor and is similar to an ordinary bipolar junction transistor (BJT) except that it has no connection to base terminal.
Its operation is based on the photodiode that exist at the CB junction, Instead of the base current, the input to the transistor is provided in the form of light.

b) optical isolator (or opto-coupler) is an electronic device designed 1 to electrically isolate one circuit from another while allowing one circuit to control the other. 0.5

3 m

Q10) The main advantage of a crystal oscillator, is that its output is a constant frequency

1 m

Q11)

$V_1 = V_a - V_b = 1 - 2 = -1V$ 1
$V_2 = V_b - V_e = 2 - 0 = 2V$ 1
$V_3 = V_b - V_c = 2 - 3 = -1V$ 1
$V_4 = V_a - V_e = 1 - 0 = 1V$ 1
$V_5 = V_d - V_e = 1 - 0 = 1V$ 1
$V_6 = V_d - V_c = 1 - 3 = -2V$ 1
$V_7 = V_e - V_c = 0 - 3 = -3V$ 1

7 m

Q12) Behavior of amplifier provided with current series feedback:
- It input and output impedances both increases 1
- voltage gain decrease 1
- Bandwidth decrease 1
- Noise decrease 1
- Harmonic distortion decreases 1

2 m

Consider only 2 point

Q13) Different types of voltage regulators
- Zener diode shunt regulator 1
- Transistor shunt regulator 1
- Transistor series regulator 1
- Controlled transistor series regulator 1
- Monolithic regulator 1
- variable feedback regulator 1
- Basic op-amp series regulator 1
- Switching regulator 1
- IC voltage regulator 1

Consider only five

5 mark

Q14) Main considerations which are kept in view while selecting an oscillator for a particular application are:
- Frequency range 1
- Accuracy and dial resolution 1
- Amplitude and frequency stability 1
- Waveform distortion 1
- output impedance 1

5 mark

Q15) 1 mark for all, because the question is not clear.

1 mark

Q16) Simplification of the given expression

$$Z = \bar{X}Y + X\bar{Y} + XY$$
$$= \bar{X}Y + X(\bar{Y} + Y) \quad 1$$
$$= \bar{X}Y + X.1 \quad 1$$
$$= \bar{X}Y + X \quad 1$$
$$= Y + X \quad 1$$

4 mark

Q17) i) $P_{in}(dc) = V_{cc} \cdot I_{CQ} = 20 \times 500 = 10^4 mW = 10 W$ 1

ii) $P_{RC}(dc) = I_{CQ}^2 \cdot R_C = (0.5)^2 \cdot 20 = 5W$ 1

iii) $P_o(AC) = I^2 R_c$

Maximum value of output ac current is 1
250 mA = 0.25A,

Hence, rms value $I = \frac{0.25}{\sqrt{2}} A$.

~~iv)~~ therefore, $P_o(AC) = \left(\frac{0.25}{\sqrt{2}}\right)^2 \cdot 20 = 0.625 W$ 1

iv) $P_{tr}(dc) = 10 - 5 = 5W$ 1

v) $P_c(dc) = 5 - 0.625 = 4.375W$ 1

vi) $\eta_{overall} = \frac{0.625}{10} \times 100 = 6.25\%$ 1

vii) $\eta_{coll} = \frac{0.625}{5} \times 100 = 12.5\%$ 1

B) i) A relaxation oscillator is one which (c) produces non-sinusoidal output 1

(ii) In RC phase shift oscillator circuits (C) pure sine wave output is possible 1

(iii) Wien bridge oscillator is most used whenever (c) wide range of high purity sinewaves is to be generated. 1

Q18) a) $f_o = \frac{1}{2\pi RC} = \frac{1}{2\pi \times 10K \times 2400pF} = 6.63KHz$ 2

b) $f_o = \frac{1}{2\pi RC}$ we get $C = \frac{1}{2\pi f_o R} = \frac{1}{2\pi \times 2.5KHz \times 100K}$

$C = 636pF$ 2 or $RC = \frac{1}{2\pi f_o} = 63.69 \times 10^{-6} s$ 2

c) Ordinary diode cannot be used as a zener diode, because the ordinary diodes are not operated in the reverse bias breakdown region to avoid them from damaging. These diodes are normally operated in forward region and never operated in reverse region, since small signal and rectifier diode are never operated in breakdown (or reverse region). Zener diode is a specially designed silicon diode which is optimized to operate in the breakdown region 1

Period (T) corresponds to 8 divisions 1

= 8div x 5ms 1

T = 40ms 1

Frequency (F) = $\frac{1}{T}$ 1

F = $\frac{1}{40 \times 10^{-3}}$ 1

F = 0.025×10^{3} Hz 1

F = 25Hz 1

/10

Q22 $I_C(sat) = \frac{(V_{CC} - V_{CE(sat)})}{R_C}$

$= \frac{10V - 0.2}{1000} = 9.8 \times 10^{-3}$ A

= 9.8 mA

$I_B = \frac{(V_{BB} - V_{BE})}{R_B}$

$= \frac{3V - 0.7V}{10\,000}$ ~~4~~

$= 2.3 \times 10^{-4}$ Ω

= 0.23 mA

$I_C = \beta_{dc} I_B$

= 50 x 0.23 mA

I_C = 11.5 mA

$I_C > I_C$ sat

Q19) $R = \frac{V_{DC} - V_{diode}}{I_{diode\ max}}$ 0,1

$= \frac{(5 - 1,4)}{40} \times 10^{+3}$

$= \frac{3,6}{40} \times 10^3$

$= 0.09 \times 10^3$

$= 90\Omega$ 0,5

Formula: 0,5 x 7 = 3,5
Answer: 0,5 x 7 = 3,5

$R_1 = R_2 = R_3 = R_4 = R_5 = R_6 = R_7 = R = 90\Omega$

_ this circuit is the base of 7-segments display
— or Decoration 3

10 M

Q20) a)

Variable	Symbol	Unit	Symbol
Pulse	— 1	— 1	— 1
Admittance	Y 1	ohm⁻¹ or Siemens or Mho	Ω^{-1} or S 1
~~Pulse~~ phase	ϕ 1	Degree or Radians 1	° or rad 1

3 marks for all, who have chosen this question but in case of pulse, because the pulse does not have unit, it is a signal.

b) As the voltmeter is placed in parallel with the element across which you want to measure voltage, if the internal resistance of voltmeter is quite small then the loading effect causes the problem 1 10 M

21) Amplitude (A) corresponds to 3 divisions 1
= 3div x 2V/div 1

A = 6V 1

Q23 a) Cut-in voltage: The forward voltage (0.3V for Ge and 0.7V for Si diodes) which the current through the diode or pn junction start rising abruptly, known as cut-in voltage or knee voltage of a diode.

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b) 1) Forward Active: In this condition, base-emitter junction is forward biased, whereas the base-collector junction is reverse biased. 1
When the transistor is in active region, collector current is proportional to the emitter current. 1
Generally, transistor is operated in this region for amplification. 1

2) Saturation: In this condition, both base junctions base emitter and base-collector junctions are forward biased. 1 When the transistor is in saturation, the collector current becomes independent of the base current and is limited by external circuitry, the transistor acts like an a closed switch. 1

3) Cut-off: In this condition, both junctions are reverse biased, the emitter does not ~~emit~~ emit carries into the base, and no carriers are collected by the collector (except a little thermally generated minority carriers) Thus the transistor ~~acts~~ acts like an open switch. 1

4) Reverse active: In this condition, the base-emitter junction is reverse biased whereas the base-collector junction is forward biased. 1
As the collector is not doped to the extent as the emitter is therefore, it can not supply (emit) as majority carriers to the base. 1
Hence, in this case very poor transistor action is achieved. 1

Con

Q24.

Input b)					Output b)					Input a)					Output a)				
A	B	C	D	E															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
0	0	1	1	1	0	0	1	1	0	0	0	1	1	0	0	0	1	1	1
0	1	1	0	0	0	1	0	1	0	0	1	0	1	0	0	1	1	0	0
					1	1	1	1	1						1	1	1	1	1

Conclusion: b) Is code converter from Gray code to binary code &

a) Is a code converter from ~~Gray to binary.~~ binary to Gray code &

connected together b) to a) will not change the input code - Gray.