KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Marks Scored:

Level : B.Sc.
Year : II

Course : PHYS 201
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 04 JUN 2019

SECTION "A"
[20Q. × 1 = 20 marks]

Choose and tick the most appropriate answer. The symbols, unless mentioned otherwise, have their usual meanings.

1. Norton's Theorem states that an entire network connected to a pair of terminals can be replaced with a single
   [a] current source in parallel with a single resistance.
   [b] voltage source in parallel with a single resistance.
   [c] voltage source in series with a single resistance.
   [d] current source in series with a single resistance.

2. Two resistors R_1 and R_2 are in parallel. If R_1 is twice the value of R_2, how much is the current (I_2) in R_2 if the total current (I_T) equals 6A?
   [a] 1A [b] 2 A [c] 3A [d] 4A

3. The voltage where avalanche occurs is called the
   [a] Barrier potential. [b] Depletion layer.
   [c] Knee voltage. [d] Breakdown voltage.

4. To a second approximation, a forward-biased diode is treated like a(n)
   [a] open switch with infinite resistance.
   [b] closed switch with a voltage drop of 0V.
   [c] closed switch in series with a battery voltage of 0.7V.
   [d] closed switch in series with a small resistance and a battery.

5. The device associated with voltage-controlled capacitance is a
   [a] LED. [b] photo-diode. [c] varactor diode. [d] Zener diode.

6. The emitter diode is usually
   [a] Forward biased. [b] Reverse biased.
   [c] Nonconducting. [d] Operating in the breakdown region.

7. In class B amplifier, the collector current, I_C, flows for
   [a] 360^0 of the ac input cycle. [b] 120^0 of the ac input cycle.
   [c] 180^0 of the ac input cycle. [d] 60^0 of the ac input cycle.

8. If the series resistance increases in an unloaded zener regulator, the zener current
   [a] Decreases.
   [b] Stays the same.
   [c] Increases.
   [d] Equals the voltage divided by the resistance.

9. With voltage-divider bias, how much is the collector-emitter voltage, V_{CE}, when the transistor is cutoff ?

[a] $V_{CE} = \frac{1}{2} V_{CC}$.

[b] $V_{CE} = V_{CC}$.

[c] $V_{CE} = 0$.

[d] $V_{CE} = \sqrt{2}\, V_{CC}$

10. A unipolar transistor uses

[a] Both free electrons and holes.

[b] Only free electrons.

[c] only holes.

[d] Either one or the other, but not both.

11. An n-channel JEFT has a pinch-off voltage –4.5 V and $I_{DSS} = 9$ mA. At what value of V_{GS} in the pinch-off region will I_D equal to 3 mA?

[a] 3V

[b] 2.6 V

[c] –1.9 V

[d] –2.9 V

12. The input stage of every op amp is a

[a] differential amplifier.

[b] push-pull amplifier.

[c] common base amplifier.

[d] common emitter amplifier.

13. Colpitts and Hartley are names that refer to

[a] types of *RC* oscillators.

[b] **inventors** of the transistor.

[c] types of *LC* oscillators.

[d] types of filters.

14. The binary equivalent of decimal 363 is

[a] 101 011 101.

[b] 101 101 011.

[c] 011 110 011.

[d] 011 101 101.

15. Which of the following truth table is TRUE for a circuit shown in Figure A-1?

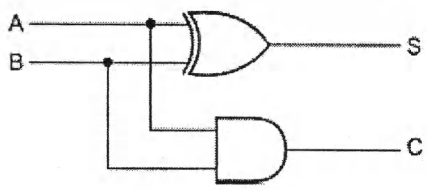

Figure A-1

[a]

A	B	C	S
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

[b]

A	B	C	S
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

[c]

A	B	C	S
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

[d]

A	B	C	S
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

Fill in the blank(s) with appropriate word(s) or value(s).

16. If the line frequency is 60 Hz , the output frequency of a half-wave rectifier is.....

17. The collector current is 1.5 mA . If the current gain is 50, the base current is .....

18. The 2's complement representation of 1101 is .....

19. A certain op-amp has an open-loop voltage gain of 100,000 and a common-mode gain of 0.2. The CMMR is .....

20. In a certain oscillator, $A_v = 50$. The attenuation of the feedback circuit must be .....

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SECTION "B"
[5Q. × 4 = 20 marks]

1. Describe the proper polarities for (a) forward-biasing a diode, and (b) reverse- biasing a diode. Sketch the complete graph of current versus voltage for a silicon diode with an offset of 0.7 V and a breakdown voltage of 75 V.

2. Define the dc alpha and dc beta of a transistor. If a transistor has $\alpha_{dc} = 100$, then calculate β_{dc}.

3. What is an oscillator? Draw the circuit diagram for the Hartley oscillator and write the expression for its frequency of oscillation.

OR

Consider the circuit in Figure B-1.
Assume $R_1 = R_2 = R_3 = 10^4 \Omega$ and $C_1 = C_2 = C_3 = 10^{-9}$ F
(a) Determine the value of R_f necessary for the circuit in Figure B-1 to operate as an oscillator.
(b) Determine the frequency of oscillation.

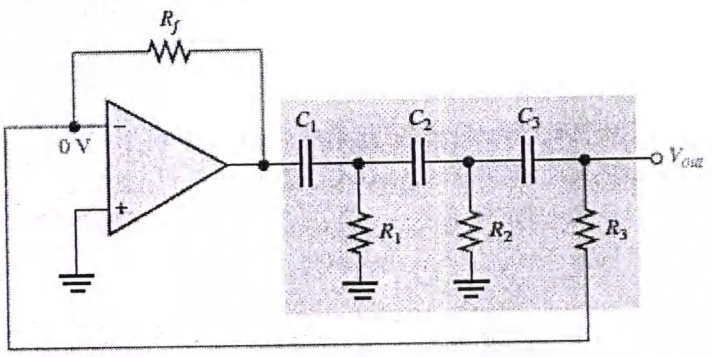

Figure B-1

4. Sketch the structure of an n-channel depletion-type MOSFET and explain their working. Draw a typical set of static drain characteristics.

OR

Show that the dc emitter current of a voltage-divider biased circuit is given by, where symbols have their usual meanings. $I_E \cong \dfrac{V_2 - V_{BE}}{R_E + \left(\dfrac{R_1}{R_2}\right)\Big/\beta_{dc}}$

5. Give the truth table and Boolean expression for NAND gate. Why NAND gate is called universal gate? Explain.

SECTION "C"

[5Q × 7= 35 marks]

6. Draw a circuit diagram for the CE amplifier as well as its dc and ac equivalent circuits. Derive the expression for the current gain, voltage gain, and power gain. Explain why there is phase inversion between input and output.

7. Find the Thevenin equivalent circuit lying left to the terminals A-B in Figure C-1. Use Thevenin's theorem to calculate the load current in Figure C-1 for the following values of $R_L = 2\ \Omega$ and $4\ \Omega$.

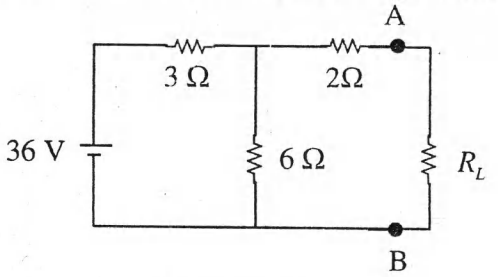

Figure C-1

OR

State the superposition theorem. Use the superposition principle to find the current through 60Ω resistor in the circuit shown in Figure C-2.

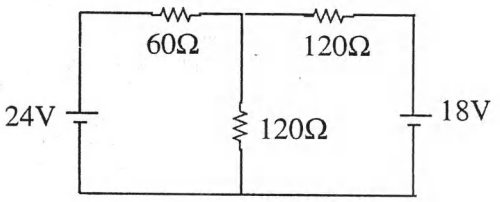

Figure C-2

8. Describe some of the characteristics of a practical op-amp. Derive an expression for the closed-loop voltage gain of an inverting amplifier. Using inverting configuration of an op-amp, explain an op-amp integrator.

9. What is the binary equivalent of Hexadecimal C5E2? Add these 8-bit numbers: 0101 0111 and 0011 0101. Show the corresponding hexadecimal. Using 1's complemental method, subtract 01101_2 from11011_2.

10. With a neat sketch, explain the working of Centre-tap full-wave rectifier and derive an expression for its efficiency.

OR

A crystal diode having internal resistance $r_d = 20\Omega$ is used for half-wave rectification. If the applied voltage $v = 50\sin\omega t$ and load resistance $R_L = 800\Omega$, Find

(i) I_m, I_{dc}, I_{rms} .

(ii) a.c power input and d.c. power output.

(iii) d.c. output voltage.

(iv) efficiency of rectification.