



BRAINWARE UNIVERSITY

Course – MSc(HN)

Principles of Basic Electronics (MHN104)

(Semester – 1)

Time allotted: 3 Hours

Full Marks : 70

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question)

1. Choose the correct alternatives for any *ten* of the following: 10 x1 = 10
- i) Ripple factor of half wave rectifier is
 a) 0.52 b) 1.21 c) 0.48 d) 1
- ii) Most lightly doped region in BJT is the
 a) emitter b) base c) collector d) none of these
- iii) When a transistor is used as switch, it operates between
 a) saturation & active region b) active & cut-off region
 c) saturation & cut-off region d) none of these
- iv) If reverse bias across a p-n junction is increased, the width of depletion region
 a) increases b) decreases c) remains unchanged d) not applicable
- v) To produce significant current in a Si diode, the forward voltage must exceed
 a) 0.3 V b) 0.7V c) 2mV d) 26 mV
- vi) A p-type semiconductor is
 a) positively charged b) negatively charged
 c) uncharged d) uncharged at 0K but charged at higher temperature.
- vii) An AND gate can be prepared by repetitive use of
 a) NOT gate b) OR gate c) NAND gate d) none of these

- viii) The electrical conductivity of pure germanium can be increased by
- a) increase of temperature b) doping acceptor impurities
 c) doping donor impurities d) all of these
- ix) The binary equivalent of decimal number 14 is
- a) $(100101)_2$ b) $(1110)_2$ c) $(1011)_2$ d) $(1101)_2$
- x) $A + \overline{A}B$ equals
- a) A b) B c) \overline{A} d) \overline{B}
- xi) How many NAND gates are required to make an AND gate
- a) 2 b) 3 c) 4 d) 5
- xii) The dynamic resistance (r) of a p-n junction depends on forward current 'I' as
- a) $r \propto I$ b) $r \propto \frac{1}{I}$ c) $r \propto \frac{1}{\sqrt{I}}$ d) $r \propto \sqrt{I}$
- xiii) IC74150 is a
- a) 8 to 1 multiplexer b) 8 to 1 demultiplexer
 c) 16 to 1 multiplexer d) 16 to 1 demultiplexer

Group – B

(Short Answer Type Question)

Answer any *three* of the following. 3 x 5 = 15

2. Draw the Fermi distribution curve for $T = 0K$ and $T > 0K$. Explain their significance.
3. Why NOR gate is called universal gate?
4. Write difference between p type and n type semiconductor. Give their band diagram.
5. Simplify the given boolean expression $Y = AB + \overline{A}C + A\overline{B}C$ ($AB + C$)
6. Draw the circuit diagram of a n-p-n transistor in CE mode. Draw the input and output characteristics of a n-p-n transistor in CE mode. For the output characteristics, show the saturation, active & cut-off regions.

Group – C

(Long Answer Type Question)

Answer any *three* of the following.

3 x 15 = 45

7. a) What is mobility, drift velocity and conductivity of intrinsic semiconductor and also find the total conductivity of intrinsic semiconductor. 1+1+1+3
- b) The resistivity of pure silicon is 2300 ohm-meter and the mobilities of electrons and holes in it are 0.135 and 0.048 meter²/ volt-sec respectively. Find the electron and hole concentrations, and the resistivity of a specimen of silicon doped with 10¹⁹ atoms of phosphorous per meter³. 6
- c) Write short note on solar cell. 3
- 8.a) Differentiate between positive and negative logic system. 3
- b) Explain how the basic gates can be realized using NAND gate. 6
- c) Implement $Y = (A + C)(A + \bar{D})(A + B + \bar{C})$ using NOR gate only. 6
- 9.a) What is multiplexer? Draw logic diagram of 4 to 1 multiplexer. 1+4
- b) Design half adder using only NAND gate. 4
- c) Write short note on Full subtractor. 3
- d) For copper at 1000k, find the energy at which the probability $f(E)$ that a conduction electron state will be occupied, is 0.90. (For copper $E_F = 7.00$ eV, $K_B = 8.6 \times 10^{-5}$ eV/K. 3
10. a) Explain the action of Zener diode, illustrating both avalanche break down and Zener break down. 5
- b) Drawing the circuit diagram of a full wave rectifier, using p-n junction diodes, explain its action. Define ripple factor and also find the value of ripple factor. 5+2+3
11. a) Convert the decimal number 53.625 into an equivalent binary number. 3
- b) State De Morgan's theorem. 3
- c) If $A\bar{B} + \bar{A}B = C$, show that $A\bar{C} + \bar{A}C = B$ 5
- d) How are the AND multiplication different from ordinary multiplication and OR addition different from the ordinary addition method? 2+2