## PHY-504

## Semiconductor Devices, Analog and Digital Electronics <br> M. Sc. PHYSICS (MSCPHY-12/13/16/17)

First Year, Examination, 2018

## Time: 3 Hours

Max. Marks : 80
Note : This paper is of eighty ( $\mathbf{8 0}$ ) marks containing three (03) Sections A, B and C. Learners are required to attempt the questions contained in these Sections according to the detailed instructions given therein.

## Section-A

(Long Answer Type Questions)
Note : Section 'A' contains four (04) long answer type questions of nineteen (19) marks each. Learners are required to answer two (02) questions only.

1. What is demultiplexer ? What is the difference between a demultiplexer and a decoder ? Show connection diagram of a demultiplexer and a decoder.
2. What is flip-flop ? Explain the principle of operation of S-R flip-flop with truth table.
3. Explain the operation of Schmitt trigger circuit (Square wave generator) using an operational amplifier. Discuss the effect of hysteresis in such a circuit.
4. Draw the circuit diagram of Wien Bridge Oscillator and obtain an expression for its frequency of oscillation.

## Section-B

(Short Answer Type Questions)
Note : Section ' $B$ ' contains eight (08) short answer type questions of eight (08) marks each. Learners are required to answer four (04) questions only.

1. Realise AND, OR, NOT using only NAND gates.
2. Draw a neat circuit diagram of transistor monostable multivibrator and discuss its working.
3. Compare common base, common emitter and common collector. Sketch a family of common base (CB) output characteristics for a transistor. Clearly indicate the cutoff, active and saturation regions.
4. What is meant by the threshold or cut-in voltage $\left(\mathrm{V}_{\mathrm{th}}\right)$ ? Why its value is higher for silicon than that for germanium?
5. What do you understand by the terms 'MINTERMS' and 'MAXTERMS' ? State and prove De-Morgan's theorem.
6. What is forbidden energy gap ? Classify insulators, semiconductors and conductors on the basis of energy band diagram.
7. Find the output voltage $\left(\mathrm{V}_{\mathrm{o}}\right)$ of the following circuit shown in Fig.


## Section-C

## (Objective Type Questions)

Note: Section 'C' contains ten (10) objective type questions of one (01) mark each. All the questions of this Section are compulsory.

Choose the correct alternative :

1. Transistor is a :
(a) Current controlled current device
(b) Current controlled voltage device
(c) Voltage controlled current device
(d) Voltage controlled voltage device
2. The transistor configuration producing highest output resistance is :
(a) Common Collector (CC)
(b) Common Base (CB)
(c) Common Emitter (CE)
(d) None of the above
3. For which of the following material, is the Hall coefficient zero?
(a) Metal
(b) Insulator
(c) Intrinsic semiconductor
(d) Alloy
4. A full adder can be made of :
(a) Two half adders
(b) Two half adders and a NOR gate
(c) Two half adders and a OR gate
(d) Two half adders and a AND gate
5. In sequential circuit, the output state depends upon :
(a) Past output states and present input states
(b) Input states only
(c) Input and Output states
(d) None of the above
6. An 8-bit A to D convertor has a resolution of :
(a) $\frac{1}{2^{4}}$
(b) $\frac{1}{2^{8}}$
(c) $\frac{1}{2^{12}}$
(d) $\frac{1}{2^{16}}$
7. The no. of comparator required to convert to realize a flash 10 bit Analog to Digital Convertor (ADC) is :
(a) 10
(b) 9
(c) 1024
(d) 1023
8. In exclusive OR gate, when output is zero the inputs are:
(a) 0,1
(b) 1,0
(c) 1,1
(d) 1, X
9. The common mode rejection ratio (CMRR) of differential amplifier (where

$$
\begin{aligned}
& \mathrm{A}_{d}=\text { differential gain } \\
& \mathrm{A}_{c}=\text { common mode gain) }
\end{aligned}
$$

is defined as :
(a) $\frac{\mathrm{A}_{d}}{\mathrm{~A}_{c}}$
(b) $\frac{\mathrm{A}_{d}-\mathrm{A}_{c}}{\mathrm{~A}_{d}}$
(c) $20 \log _{10} \frac{\mathrm{~A}_{d}}{\mathrm{~A}_{c}}$
(d) $20 \log _{e} \frac{\mathrm{~A}_{d}}{\mathrm{~A}_{c}}$
10. For a step input, the output of an integrator is :
(a) a pulse
(b) a triangular waveform
(c) a spike
(d) a ramp

S-188

