

PHY-504**Semiconductor Devices, Analog
and Digital Electronics**

M. Sc. PHYSICS (MSCPHY-12/13/16/17)

First Year, Examination, 2018

Time : 3 Hours**Max. Marks : 80**

Note : This paper is of **eighty (80)** 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.

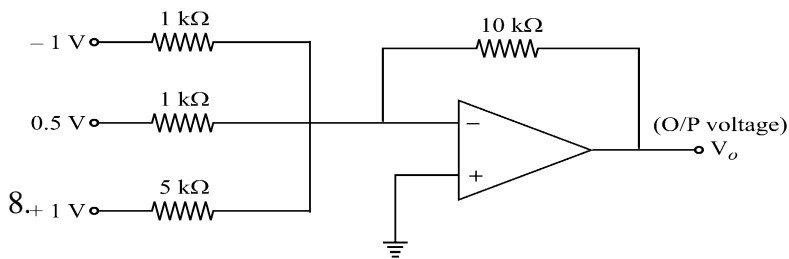
1. What is demultiplexer ? What is the difference between a demultiplexer and a decoder ? Show connection diagram of a demultiplexer and a decoder.
2. What is flip-flop ? Explain the principle of operation of S-R flip-flop with truth table.
3. Explain the operation of Schmitt trigger circuit (Square 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 (V_{th}) ? 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 (V_o) 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

A_d = differential gain

A_c = common mode gain)

is defined as :

- (a) $\frac{A_d}{A_c}$
- (b) $\frac{A_d - A_c}{A_d}$
- (c) $20 \log_{10} \frac{A_d}{A_c}$
- (d) $20 \log_e \frac{A_d}{A_c}$

10. For a step input, the output of an integrator is :

- (a) a pulse
- (b) a triangular waveform
- (c) a spike
- (d) a ramp

