 Roll No. ……..

PHY–504

Semiconductors Devices, Analog and Digital Electronics

M. Sc. PHYSICS (MSCPHY–12/13/16)

First Year, Examination, 2017

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 do you mean by N-type and *p*-type semiconductor. Explain with the help of diagram how free electrons and holes contribute to electric current.
2. Define α and β of a transistor and derive relationship between them. Sketch a family of common emitter output characteristics for a transistor. Clearly indicate the cut off, active and saturation regions.
3. State and prove De-Morgan's theorem. Discuss the working of half adder and full adder and give their truth table.

4. What is Barkhausen criterian for the frequency stability of an oscillator ? Draw and discuss in detail the circuit of an R-C phase shift oscillator.

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. Draw the block diagram of a regulated power supply and explain each block in detail.
2. Show that both NAND gate and NOR gate are universal gates.
3. Realize X-OR operation using :
   (a) Only NAND gates
   (b) Only NOR gates
4. What is Op-amp. ? Draw equivalent circuit of an Op-amp. (Operational amplifier). Write ideal characteristic of Op-amp.
5. Draw the circuit diagram of Op-amp. as Summer and find out the expression for output.
6. With the help of neat diagram explain the working of R-2R ladder network type digital to analog converter (DAC).
7. Compare Asynchronous and Synchronous Counter. Design a Mod-10 asynchronous counter using T Flip-Flop.
8. With the help of logic diagram and function table explain a 4-input multiplexer.

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.

1. ASCII code is a :
   (a) 5-bit code
   (b) 7-bit code
   (c) 8-bit code
   (d) 10-bit code

2. The fastest ADC (Analog to Digital Converter) is :
   (a) Counter-type
   (b) Flash type
   (c) Successive approximation type
   (d) Dual slope type

3. How many states a 6-bit ripple counter can have ?
   (a) 6
   (b) 12
   (c) 32
   (d) 64

4. The negative feedback in amplifier :
   (a) reduces the voltage gain
   (b) increases the voltage gain
   (c) does not affect the voltage gain
   (d) None of the above

5. A load line is a graph between :
   (a) I_C and V_{CC}
   (b) I_C and V_{CE}
   (c) I_E and V_{BE}
   (d) I_C and V_{BE}

6. Wien bridge oscillator uses :
   (a) Positive feedback
   (b) Negative feedback
   (c) Both positive and negative feedback
   (d) No feedback

7. The voltage gain of transistor amplifier is lowest in :
   (a) CE configuration
   (b) CB configuration
   (c) CC configuration
   (d) None of the above

8. The voltage gain of ideal voltage follower is :
   (a) 1 (b) < 1
   (c) 0 (d) Infinity

9. The ideal value of Common Mode Rejection Ratio (CMRR) is :
   (a) 1 (b) 0
   (c) ∞ (d) $-\infty$

10. The no. of flip-flops required in a decade counter is :
   (a) 2 (b) 3
   (c) 4 (d) 10