Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2023

Programme Name: B.TECH.(NAOE)

Semester: V

Subject Code: UG12T2505

Subject Name: Basic Electronics Engineering

Date: 15.12.2023 Max Marks: 70

Duration: 03 Hrs Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.
(iii) Scientific Calculator is permitted.

Section A

Ten MCQs/Fill in the Blanks of One Mark each – Choose the correct answer. Objective Questions (MCQ/True or False/Fill in the blanks/Match the following) 10 X 1 = 10 Marks

1) Which among the following is a current controlled device
   a) MOSFET
   b) IGBT
   c) BJT
   d) JFET

2) Calculate the value of I_E in a transistor for which $\beta = 50$, $I_B = 20\mu A$
   a) 1.02mA
   b) 1.5mA
   c) 2 mA
   d) 3mA

3) The magnitude of current through a Zener diode in a Zener voltage regulator under full-load condition is
   a) Maximum

b) Zero
c) Remains constant irrespective of load
d) Minimum

4) In LC transistor oscillators the active component is used as
a) Inductor
b) Capacitor
c) Resistor
d) Transistor

5) The minimum number of NAND gates required to design an AND gate.
(a) 4

(b) 3

(c) 2

(d) 1

6) Why doping is required?
(a) To decrease the conductivity of a pure or intrinsic semiconductor.

(b) To increase the conductivity of a pure or intrinsic semiconductor.

(c) To engineer a different form of semiconductor material with higher level of conductivity.

(d) Both (b) and (c)

7) The type of feedback used to design an oscillator is _____.
(a) Negative

(b) Positive

(c) Both (a) & (b)

(d) None of these

8) If the frequency of a wave is 20 *Hz*, the time period is _____.
(a) 0.2 sec

(b) 0.05 sec

(c) 2.0 sec

(d) 20.0 sec

9) A message signal of frequency 20 kHz and peak voltage of 20 volts is used to modulate a carrier signal of frequency 2 MHz and peak voltage of 40 volts. The value of modulation percentage is equal to _____.

(a) 33 %

(b) 50 %

(c) 25 %

(d) 75 %

10) Consider the following statements for a Bipolar Junction Transistor.

1. It is a current controlled device.

2. It is made up of three different types of semiconductor materials.

3. Both the majority and minority carriers participate in the conduction process.

4. The minority current component is dependent upon temperature.

Which of these statement(s) is(are) correct?

(a) 1, 2, 3 and 4

(b) 2, 3 and 4

(c) 1, 3 and 4

(d) 1, 2 and 3

Section B

Five Short Answer type Questions of Two marks each.

5 X 2 = 10 Marks

11. What are the three different configurations in transistor biasing?
12. Draw the circuit diagram and truth table of S-R Flip-flop mentioning the remark of each states?
13. State the Barkhausen's criteria for oscillation?
14. What is Modulation? Mention any two major requirements of it?
15. Why the base region of a BJT is lightly doped and collector region has the largest area?

Section C

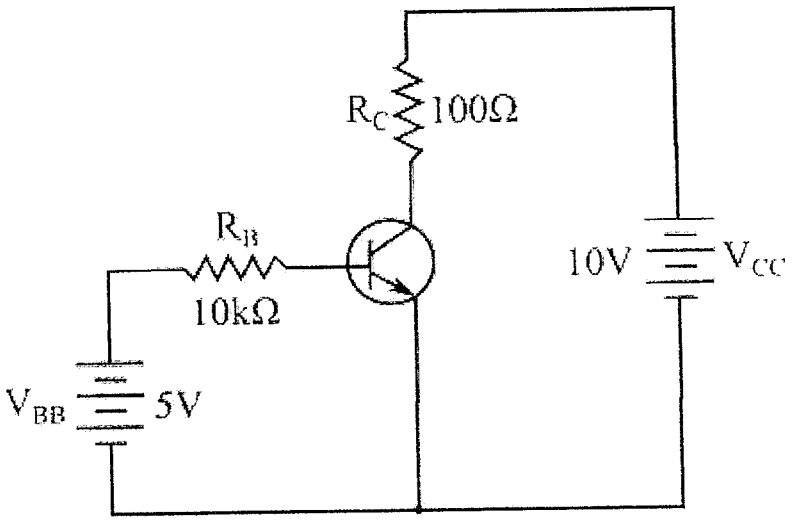
Seven Long Answer type Questions of Two marks each. Answer any Five.

10 X 5 = 50 Marks

16. Define shift register and explain the following two types of shift register with clock diagrams
    (a) 4 bit Serial-in serial out (SISO) [5M]
    (b) 4 bit Parallel-in serial out (PISO) [5M]

17. Explain the functioning of Wien-bridge oscillator with neat circuit diagram.

18. (i) Determine the value of V_{CB} in the transistor circuit shown in the figure given below. The transistor is of Silicon and has $\beta = 150$.



(5 marks)

18. (ii) Simplify the boolean expression $Y = \overline{A \cdot \overline{B} \cdot (A + C)} + \overline{A} \cdot B \cdot \left(\overline{A + B + \overline{C}}\right)$ and implement the simplified expression using logic circuit diagram.

(3+2 marks)

19. Draw and explain 3-bit Binary Weighted Resistor Digital-to-Analog (DAC) converter.

20. (i) An AM wave is represented by the expression:

$$v(t) = 5[1 + 0.6cos(6280t)]cos(62800t)$$

Evaluate the following: [5M]

(a) What are the minimum and maximum amplitudes of the AM wave?

(b) What frequency components are contained in the modulated wave and what is the peak amplitude of each component?

(c) Modulation Index

(d) Carrier Power, Side Band Power, and Total Power

(e) Efficiency

20. (ii) Convert $(123.125)_{10}$ to Base-2, Base-8, Base-16. [5M]

21. Design a 3-bit asynchronous UP/DOWN counter.

22. Explain the process of generating Amplitude Modulated Wave using the Square Law Modulator.