

[79]

SARDAR PATEL UNIVERSITY
Fifth Semester B. Sc. Examination
Subject: PHYSICS [US05CPHY54]
Analog and Digital Circuits



Date: 8/10/2025 (Wednesday)

Time: 10:00 A.M. To 01:00 P.M.

Total Marks: 70

Note: (i) All the symbols have their usual meanings.

(ii) Figures at the right side of questions indicate full marks.

Que.-1

To answer the MCQs choose the correct option.

[10]

1. In a small signal transistor amplifier voltage gain decreases in the higher frequency range due to _____.
 (a) reactance of coupling capacitor
 (b) reactance of bypass capacitor
 (c) reactances of coupling capacitor and bypass capacitor
 (d) reactance of interelectrode capacitors.
2. The complimentary symmetry amplifier consists of _____.
 (a) two PNP transistors (b) two NPN transistors
 (c) two diodes (d) one NPN & one PNP transistors
3. In an inverting opamp the input resistance is $1k\Omega$ and feedback resistance is $5k\Omega$ then voltage gain is _____.
 (a) 5 (b) 2 (c) 6 (d) 1
4. In an inverting opamp the phase difference between input and output voltages is _____.
 (a) π (b) 2π (c) $\pi/2$ (d) 0
5. The base of hexadecimal number system is _____.
 (a) 8 (b) 10 (c) 2 (d) 16
6. A byte is a string of _____ bits.
 (a) 4 (b) 8 (c) 2 (d) 16
7. If the output of NAND gate is inverted then it becomes _____ gate.
 (a) NAND (b) NOR (c) OR (d) AND
8. A flipflop is _____ state device.
 (a) 4 (b) 8 (c) 2 (d) 16
9. Which of the following input combination leads to race condition in RS flip flop?
 (a) $R=1$ & $S=1$ (b) $R=0$ & $S=1$
 (c) $R=1$ & $S=0$ (d) $R=0$ & $S=0$
10. How many flip flops are required to load 1011 binary number into register?
 (a) 2 (b) 3 (c) 4 (d) 1



[P.T.O.]

(1)

Que.-2

Answer briefly any ten of the following questions.

[20]

- (1) State the draw backs of phase inverter circuit.
- (2) What is cross over distortion in class B push pull amplifier?
- (3) What is harmonic distortion? How it can be minimized?
- (4) Define following opamp parameters;
(i) input bias current and (ii) input offset current
- (5) Define following opamp parameters.
(i) CMRR and (ii) slew rate
- (6) When does the opamp work as a voltage follower?
- (7) State the de Morgan's theorem.
- (8) Implement basic gates with the help of NAND gates.
- (9) Give the circuit symbol and truth table of two inputs EX-OR gate.
- (10) What is the drawback of ripple counter? How does it overcome using synchronous counter?
- (11) Explain how ring counter can be used.
- (12) State the applications of registers.



- Que.-3 (a) Discuss effect of emitter bypass capacitor on low frequency gain of a transistor amplifier with necessary derivation. [06]
(b) With the help of high frequency analysis of a CE transistor amplifier show that gain bandwidth product is $f_T = h_{fe} \cdot f_{\beta} \dots$ [04]

OR

- Que.-3 (a) Describe the working of class A push pull amplifier with suitable circuit diagram and show that its output is free from even harmonics. [06]
(b) With necessary diagram show that maximum achievable efficiency in class B condition of push pull amplifier is 78.5%. [04]

- Que.-4 (a) Discuss A.C. analysis of dual input balanced output configuration of differential amplifier with suitable diagrams and obtain expressions for differential gain A_d . [06]
(b) Explain the application of an opamp as a logarithmic amplifier. [04]

OR

- Que.-4 (a) State the characteristics of an ideal opamp. Give the circuit diagram of an ideal non inverting opamp and obtain the expression for its voltage gain. [06]
(b) Explain the application of opamp as an integrator. [04]

- Que.-5 (a) What is a gate? Explain the working of the two inputs OR gate with suitable circuit diagram. [06]
(b) Explain the working of NOT gate with suitable circuit diagram. [04]

OR

- Que.-5 (a) Explain the working of two inputs AND gate circuit with suitable circuit diagram. [06]
(b) Convert the following binary numbers into decimal numbers. [04]
(1) 1010 (2) 10101
(ii) Convert the following hexadecimal numbers into binary numbers.
(1) 3C (2) 6B2

- Que.-6 (a) Describe the working of JK flip flop with suitable logic diagram. [06]
(b) Explain working of D flip flop with suitable logic diagram. [04]

OR

- Que.-6 (a) Explain the working of 4-bit ripple counter with suitable logic diagram and clock waveform. [06]
(b) Explain the working of RS NOR flip flop. [04]

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