

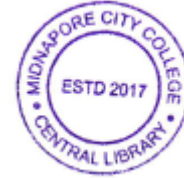
2025

M.Sc. 1st Semester Examination

PHYSICS

Paper : PHSC405X0

[Electronics-I]



Full Marks : 50

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

[Analog]

Answer any *two* questions : $2 \times 2 = 4$

1. Explain the following terms: Tropospheric waves and Sky wave propagation.
2. What is the slew rate of an Operational Amplifier (Op-Amp)? What would the value of the slew rate be for an ideal Op-Amp?
3. What does "skip distance" mean in the context of radio wave propagation?
4. If the peak electron concentration of an ionosphere layer is 10^5 cm^{-3} , what is the critical frequency of that layer?

P.T.O.



(2)

Answer any *two* questions : $4 \times 2 = 8$

5. Derive the expression for CMRR of emitter coupled differential amplifier after drawing its proper circuit diagram and hence derive the condition for which it will offer infinite CMRR.
6. Explain the method of generation of Single Side Band (SSB) signal using phase cancellation method. Draw the waveform of SSB signal.
7. Describe the functioning of a superheterodyne FM receiver using a suitable block diagram. Also mention the intermediate frequency employed in an FM receiver.
8. Explain the working principle of Doppler RADAR.

Answer any *one* question : $8 \times 1 = 8$

9. (a) Explain how the distance of a fixed target can be found by using two frequency CW radar.
(b) Obtain the RADAR range equation with a proper derivation. $4+4$
10. (a) Derive the expression for the radiation resistance of a short electric dipole carrying high frequency AC signal and hence show that for efficient transmission of signal the dimension of the antenna should be comparable to the wavelength of the signal to be transmitted.
(b) A differential amplifier has CMRR of 80 dB and

(3)

its differential mode gain is 40,000. Find the common mode gain. Write the value of CMRR of an operational amplifier when it is an ideal one.

5+3

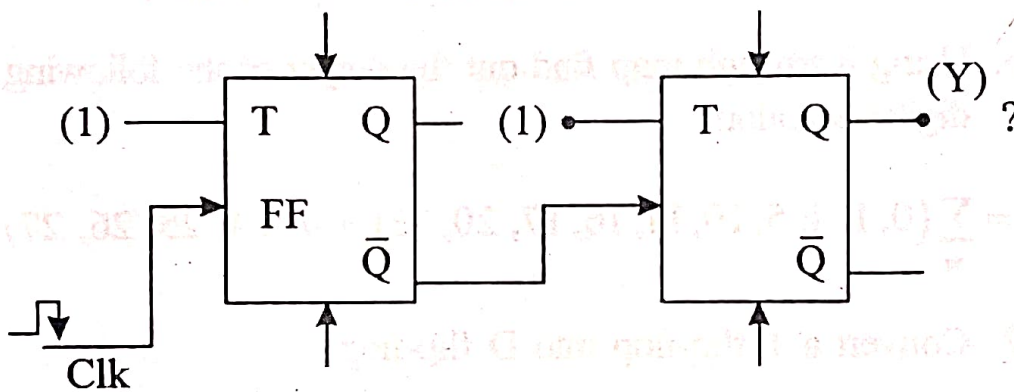


Group - B

[Digital]

Answer any *two* questions : $2 \times 2 = 4$

11. Draw the output (Y) waveform of the following circuit :



Assume all $pr = clr = 1$ and $Y_{initial} = 0$

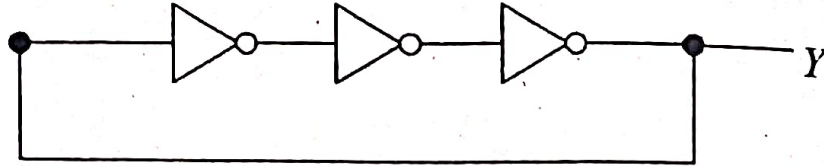
12. In an 8-bit SISO register initial content is 10101111. If the data 11001100 is to be stored in the register how many clock pulse will be required? What will be the content after 4 consecutive clock pulses?

13. If 1 kHz and 2 kHz signals are applied in the input of an EX-OR gate then draw the output waveform.

P.T.O.

(4)

14. Considering $t_{pd} = 10$ ns for each gate, what will be the frequency of the following astable multivibrator?



Answer any *two* questions : $4 \times 2 = 8$

15. Draw a circuit diagram of a 4-bit SISO shift register using JK flip-flop. Draw the transition table for entering data 0111 and draw the corresponding waveform.

16. Using Karnaugh map find out the output of the following digital equation :

$$Y = \sum_m (0, 1, 4, 5, 10, 11, 16, 17, 20, 21) + d (24, 25, 26, 27)$$

17. Convert a T flip-flop into D flip-flop.

18. Draw the circuit diagram of an astable multivibrator using IC555 and find out the value of the components for frequency 10 kHz and duty cycle 75%.

Answer any *one* question : $8 \times 1 = 8$

19. (a) What is the difference between ripple counter and synchronous counter?

- (b) Draw a circuit which can convert a 10 kHz signal into 1 kHz signal.



(5)

- (c) Write down the truth table of a digital circuit which receives 3 bit binary numbers at the input and gives the corresponding square at the output.

2+4+2

20. (a) Write down the excitation table of a JK flip-flop.
- (b) Give the output states of a twisted ring counter which starts from 100 output state.
- (c) How can you convert a 4 bit parallel data into a serial data using register circuit? 2+2+4

Internal Assessment : 10 marks
