2008

PHYSICS

PAPER—PH-1104 (A & B)

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

### GROUP—A

[*Marks* : 20]

Answer **Q. No. 1** and any *one* from the rest

1. Attempt any *five* bits :   2 x 5

   (*a*) What do you mean by skip distance in case of radio wave transmission ?

(b) An FM transmitter uses a carrier frequency of 107 MHz, compute the length of the dipole antenna required to receive that FM signal.

(c) Define slew rate of an OP-Amp. What should be its value for an ideal OP-Amp?

(d) Find $v_0 (j\omega)$ in terms of $v_i (j\omega)$ for the following circuit:
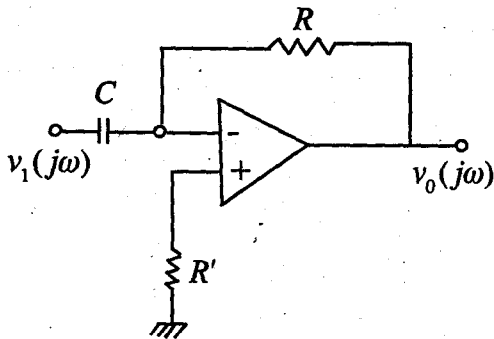
(e) What is Secant law in case of radio wave propagation.

(f) Define space wave and sky wave.

(*Continued*)

(g) A 2·5 kW carrier signal is amplitude modulated by a single frequency sine wave signal. If the modulation index is 60%, determine the total power of the modulated wave.

2. (a) Draw the circuit diagram of a OP-Amp differentiator and find out the expression for the output voltage. Draw the nature of the output waveforms if the input is a (i) square wave and (ii) triangular wave.

(b) Derive radar range equation in free space. Explain how radar range can be increased. $(1 + 1 + 1 + 1) + (5 + 1)$

3. (a) Find out the expression for the frequency modulated wave and its spectral components, modulated by a sine wave and hence find out the theoretical bandwidth of FM.

(b) Explain the operation of a varactor diode FM modulator with necessary circuit diagrams.

$(2 + 3 + 1) + 4$
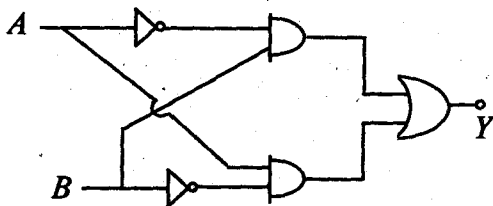
GROUP—B

[*Marks* : 20]

Answer **Q. No. 1** and any *one* from the rest

1. Answer any *five* of the following questions :   2 x 5

  (*a*) Show how an OR-gate may converted to an AND-gate.

  (*b*) Minimize the following Boolean expression using K –map :

  $$Y = \bar{A}B\bar{C}D + \bar{A}B C\bar{D} + A BC\bar{D} + A\bar{B}CD$$

  (*c*) Find the Boolean expression of the following circuit and identify it.

(d) Realize the Boolean function

$$Y = (A + B)(\bar{A} + B)$$

using only NAND gates.

(e) What do you mean by a 'latch' circuit?

(f) What is the equivalent binary number of $FA8_{16}$?

(g) Write the truth table of a 'T flip-flop'.

(h) Write the difference between ROM and PROM.

2. (a) Show how clocked RS-FF can be constructed from NAND gates. How 'preset' and 'clear' are incorporated in the circuit?

(b) Minimize the following expression using K-map:

$$f(A, B, C, D) = \Sigma m(0, 2, 4, 5, 6, 8, 10, 12) + d(1, 14).$$

(c) (i) What is the limitation of this SR flip-flop?

(ii) What is a 'D flip-flop'? Discuss the principle of operation of 'D flip-flop' with a circuit diagram?

(iii) What is the advantage of 'D-flip-flop' over
S-R one ?   (2 + 1) + 3 + (1 + 2 + 1)

3. (a) Convert -18 and +17 in 2's complement form
and then add them in 2's complement method.
Represent -9 in 1's complement notation.

(b) What do you mean by 'overflow' in digital
system ? How it can be detected ?

(c) What is the 'floating-point' representation of
a number ?

(d) What are half-adder and full adder ? Give the
circuit diagram a full-adder and explain it.

3 + 2 + 2 + (1 + 2)

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