2018

M.Sc.

1st Semester Examination

PHYSICS

PAPER—PHS-104

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

Unit—104.1

[Marks : 20]

Answer Q. No. *1*, *2* and any *one* from the rest.

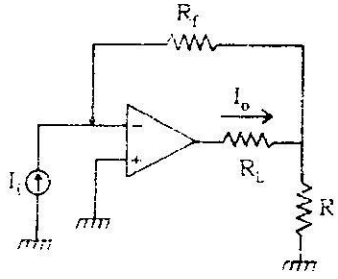
1. Answer any *two* questions : 2×2

(a) Why FM & TV signals cannot cover a long distance through air ?

(b) An FM broadcast station is assigned a channel from 90 MHz to 90.2 MHz. (i) What is the maximum permissible value of m_f for $(f_m)_{max}$ = 10 KHz ? (ii) How many side band frequencies exist on each side of the centre frequency ?

(c) Draw the block diagram of FM stereo transmission system.

(d) In the following OP-Amp circuit, find out the expression for $\frac{I_o}{I_i}$.



2. Answer any *two* questions : 2×4

(a) Define the following terms — Skip distance, Maximum Usable Frequency (MUF), Sky wave propagation and Ground wave propagation.

(b) Explain Doppler Radar.

(c) Explain in details — Why modulation is necessary in communication ?

(d) Explain how a current mirror circuit is designed using low β transistors in the design of an OP-Amp with proper circuit diagram and necessary derivation.

3. (a) Draw the circuit diagram of a balanced modulator and write the use of it. Derive the expression for the output signal of a balanced modulator and also draw its waveform.

(b) Explain the principle of generation of single side band signal using phase cancellation method. 5+3

4. (a) Derive Radar range equation and hence explain how radar range can be increased ?

   (b) What is the need of a duplexer in a RADAR system ?

   (c) Draw the circuit diagram of Foster-Seeley Discriminator. 5+1+2

Unit—104.2

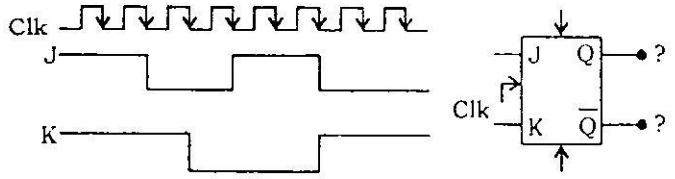
[Marks : 20]

Answer Q. No. *1*, *2* and any *one* from the rest.

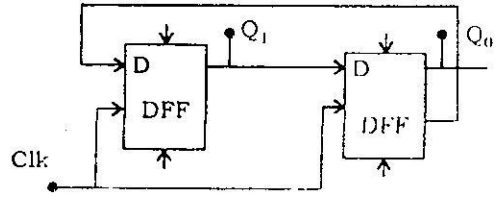
1. Answer any *two* questions : 2×2

   (a) In a MOD-10 ripple counter the propagation delay of every flip-flop is 2.5 nsec. What is the maximum frequency that can be used as the clock signal ? What will be frequency of MSB of that counter output corresponding to the maximum clock signal ?

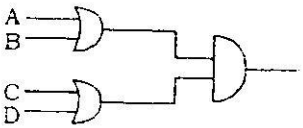
   (b) Draw the output wave form of the following circuit. Assume $Q_0 = 0$.



   (c) Explain the output states of the following circuit. Assume the initial states.



(d) Convert the following circuit using NOR gate only.



2. Answer any *two* questions : 2×4

(a) In a 4-bit digital system the input is in BCD form and output goes high only when any two input bits are in high state. Write down the truth table and design the circuit with NAND gate.

(b) Convert 3-bit parallel data to 3-bit serial data by proper circuit diagram. Explain the operation clearly.

(c) Differentiate astable multivibrator and monostable multivibrator. Give example of both in proper circuit diagram.

(d) Convert DFF into TFF.

3. (a) Solve the following equation by K'map :

$$Y = \Pi_M(0, 4, 5, 9, 12) \cdot d(1, 2, 10, 13, 15).$$

(b) Design a circuit to determine $A > B$ where $A = A_1A_0$ and $B = B_1B_0$.

(c) Give the circuit of MOD-5 counter. 3+3+2

4. (a) Design a synchronous counter which has only (00) and (10) states.

(b) Design a 3-bit bidirectional SISO register. What are the different uses of register ? 4+4

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