2016

M.Sc. 1st Semester Examination

PHYSICS

PAPER—PHS-104

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

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

Illustrate the answers wherever necessary.

Use separate Answer-scripts for Group-A & Group-B

Group—A

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

1. Answer any five bits : 2×5

   (i) Explain the term maximum usable frequency (MUF) in case of radio wave communication.

   (ii) Write the advantages of NMOSFETs over PMOSFETs.

   (iii) What is fading in radio wave communication ?

   (iv) Explain why terrestrial TV signals cannot be transmitted over long distances.

(v) Draw the circuit diagram of a differentiator using OP-Amp and derive the expression for the output signal in terms of the inpur signal.

(vi) Suppose a 500 KHz carrier wave is amplitude modulated by an audio signal, whose frequency ranges from 200 Hz to 10 KHz. Find the frequency span of the Lower Side Band and the Upper Side Band signals.

(vii) A differential amplifier has a CMRR = 80 dB and its differential mode gain is 40,000. Find the common mode gain.

2. (a) Derive the expression for the radiation resistance of a half wave antenna. 4

(b) Explain how RADAR range can be increased by deriving the expression for the Radar range equation in free space. 1+4

(c) What is the need of a duplexer in a RADAR system ? 1

3. (a) Suppose only LSB is transmitted and there is a provision for generation of carrier signal at the receiver. Show that using these signals it is possible to recover the modulating signal. Draw the block diagram of the process. 3

(b) Draw the circuit diagram of a DSB-SC signal generator and explain its operation by deriving the expression for its output voltage. 1+3

(c) Draw the circuit diagram of a differential amplifier using transistors and derive the expression for CMRR of this differential amplifier. 3

Group—B

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

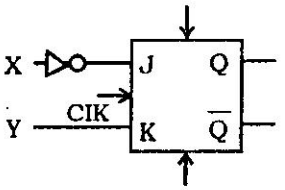
1. Answer any *five* questions : 5×2

(a) Write the truth table for a 4-bit digital system whose input is BCD and output is high only when the MSB and LSB are in same phase.

(b) Design a MOD-2 counter and draw the output waveform.

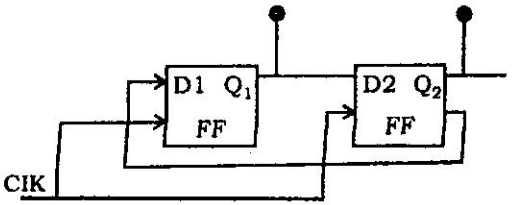
(c) Draw the circuit of 1 bit comparator of two signals.

(d)



Write down the excitation table for the above XY Flip Flop.

(e) What are the possible states for the following circuit. Assume the initial state (0, 0)



(f) Construct a circuit with NAND gate for the following digital equation

$$Y = A + B.\overline{C}$$

(g) What do you mean by bi-stable and monostable multivibrator ?

2. (a) Solve the following digital equation

$$Y = \sum_{m} m(0, 1, 4, 5, 10, 11) + d(13, 14, 15)$$

(b) Writhe the truth table for even parity generator for 4-bit signal. Design the required circuit.

(c) Design an astable multivibrator with 555 timer. 4+3+3

3. (a) Design an asynchronus, 3 bit, up-down counter and explain briefly.

(b) Construct 2 input bidirectional SISO register. What is the difference in use between PISO and SIPO register.

(c) What do you mean by ring counter ? 4+4+2

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