PG/IS/PHS-104/10

M.Sc. 1st Semester Examination, 2010

PHYSICS

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

PAPER—PHS- 104 A

(*Analog Electronics*)

[*Marks* : 20]

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

1. Answer any *five* questions :   2 x 5

   (*a*) Define the term slew rate of an operational amplifier and discuss its importance.

   (*b*) Discuss relative merits and demerits of DSB-TC and DSB-SC.

(c) Define surface wave in case of radio wave communication.

(d) Find the transfer function for the ideal Op-Amp configuration shown in the figure below :
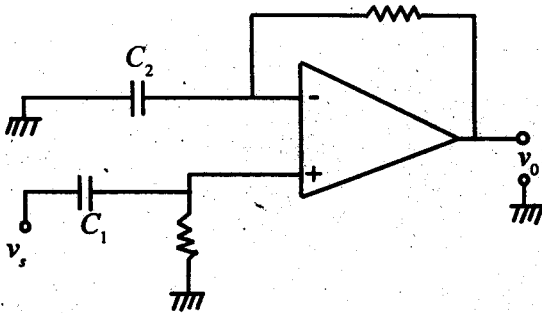
(e) Define skip distance in case of radio wave propagation.

(f) State Carson's rule of thumb for the bandwidth of FM.

(g) An FM transmitter sends out a 100 MHz carrier wave frequency modulated by a 15 kHz sinusoidal audio signal. The maximum frequency deviation is 30 kHz. Find the modulation index.

(Continued)

2. (a) Derive Radar range equation in free space. Explain how radar range can be increased ? 5 + 1

   (b) Explain how the distance of a fixed target can be found by using two frequency CW radar. 4

3. (a) Find out the expression for the frequency modulated wave, modulated by a sine wave and also find out the spectral components of the FM signal. 2 + 2

   (b) Draw a simple circuit using a varactor diode to produce a FM wave and discuss its operation quantitatively. 3

   (c) Draw the circuit diagram of a Foster-Seeley discriminator and explain its operation qualitatively. 3

PAPER—PHS- 104 B

### (*Digital Electronics*)

[*Marks* : 20]

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

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

   (a) What are the roles of 'preset' and 'clear' in flip-flop circuits ?

(b) In a 8-bit SISO register the initial data stored is 11110000 and the applied serial data is 00001111. After the application of 4 clock pulses what will be the data in the register?

(c) Convert the following expression from SOP to POS by Karnaugh map :

$$F = A\bar{B} + B\bar{A}.$$

(d) Assuming the initial output '0', find out the outputs with the application of two clock pulses in the following F.F. circuit.
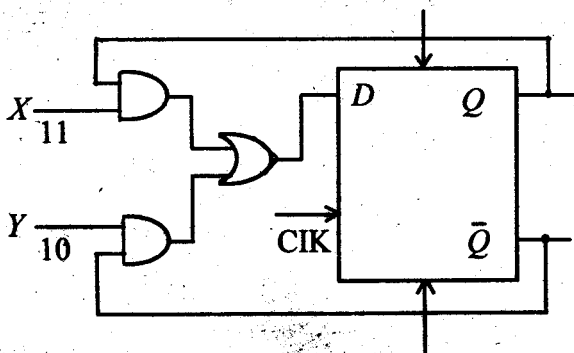
(e) Draw the waveforms of two the outputs of a transistorised astable multivibrator.

(*Continued*)

(*f*) Give the simplest circuit to realize the following digital expression :

$Y =$

AB \ CD	00	01	11	10
00	1			1
01	1	1	1	1
11				
10	1			1

(*g*) Minimize the following Boolean expression with Karnaugh map :

$$F = ABC + AB\bar{C} + A\bar{B}C + \bar{A}BC + \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C.$$
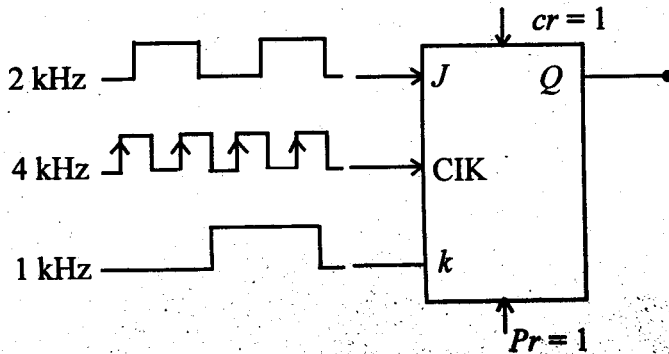
2. (*a*) What is a 'Asynchronous Counter' ? Discuss the principle of operation of this counter capable to count 15 consecutive pulses. Can you call this counter a ripple counter ? Justify your answer. 5

(*b*) Give the basic idea of 7-segment display system with the proper truth table. $2\frac{1}{2}$

(c) Give the output waveform in the following circuit. Assume $Q_n = 0$:

$2\frac{1}{2}$

3. (a) A staircase light is controlled by two switches, one is at the top of the stairs and the other at the bottom of the stairs. It is OFF when both the switches are ON or when both the switches are OFF. Realize the circuit using minimum number of NAND gates.   4

(b) Give a neat circuit diagram of PISO register which can store 4 bit number.   3

(c) Solve the following digital equation by K' map method :   3

$$Y = \Pi\ M(1, 4, 6, 8, 10, 12) \cdot d(3, 7, 9, 11).$$