PG (NEW) CBCS
M.Sc. Semester-I Examination, 2019
PHYSICS
PAPER: PHS-104

Full Marks: 40   **Time: 2 Hours**

Write the answer for each unit in separate sheet

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.

PHS 104.1: ANALOG ELECTRONICS - I

Marks: 20

1. Attempt any <u>two</u> of the following: **(2 × 2 = 4)**
   a. What is Vestigial Side Band (VSB) modulation and where it is used?
   b. What is duplexer and where it is used?
   c. What is slew rate of an OP-AMP? For an ideal OP-AMP, what should be its value?
   d. What is secant law for sky-wave propagation?

2. Attempt any <u>two</u> of the following: **(4 × 2 = 8)**
   a. How you can create current to voltage converter using OP-AMP?
   b. Show that for ionospheric wave, the refractive-index of the ionised medium is given by $n = \sqrt{1 - \frac{81N}{f^2}}$, where $e = 1.6 \times 10^{-19}$ C, $m = 9.1 \times 10^{-31}$ kg and $\epsilon_0 = 8.854 \times 10^{-12}$ F/m.
   c. Draw the circuit diagram of a balanced modulator and explain with necessary derivation, how it can generate DSB-SC signal?
   d. (i) Find the BW of the channel required to transmit an FM signal with $\Delta F = 75$ KHz and maximum frequency of the modulating signal $= 15$ KHz.
   (ii) A differential amplifier has CMRR=100dB. Its differential mode gain is 10,000. Find its common mode gain.

3. Attempt any <u>one</u> of the following: **(8 × 1 = 8)**

   a. What do you mean by amplitude modulation? Draw a circuit using BJT which generates AM modulated signal. Draw the block diagram of a Superheterodyne FM radio receiver.   **(2+3+3)**
   b. i) Derive radar range equation and explain how the radar range can be increased?   **(5)**
   ii) Explain how the distance of a fixed target can be found out by using two frequency CW radar.   **(3)**

(Turn Over)

PHS 104.2: DIGITAL ELECTRONICS - I

Marks: 20

1. **Answer any <u>two</u> of the following:** $\qquad$ $(2 \times 2 = 4)$

   a. Draw a 8:1 MUX using two 4:1 MUX.

   b. Convert the clocked D FF into a JK-type FF.

   c. Simplify using K map $f(a,b,c,d) = \sum_m(0,1,9,12,13,14,15) + d(4,5,8,9)$

   d. Draw the waveforms to shift the binary number 1010 into the serial-in and serial-out shift register.

2. **Answer any <u>two</u> of the following:** $\qquad$ $(4 \times 2 = 8)$

   a. Design a 4-bit ripple carry Adder.

   b. Design a full adder circuit using 4:1 MUX.

   c. Draw the K-map for the function F and minimise the function F' in sum of product form (a) F=W'X'YZ+WYZ (b)F=A'B'C'D'+A'CD+ABCD

   d. Design a MOD-10 counter. Also draw the timing waveforms.

3. **Answer any one of the following** $\qquad$ $(8 \times 1 = 8)$

   a. Design a BCD to 7 segment decoder circuit.

   b. i) In an astable multivibrator $R_A = 2.2 k\Omega$, $R_B = 3.9 k\Omega$ and c=0.1 μF(R_A & R_B are charging resistor and discharging resistor). Determine the positive pulse width t_c, negative pulse width t_d and free running frequency f_0. What is the duty cycle of the output waveform? $\qquad$ **(4)**

   ii) A digital system receives 4 bit binary numbers. Design a display system to display only the BCD numbers 0 to 9 and for non-BCD numbers the display should show the figure of English alphabet E which indicates error.

   $\qquad$ **(4)**

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