M.Sc. 1st Semester Examination, 2019

PHYSICS

PAPER – PHS-104.1 & 104.2

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

PHS-104.1

(*Analog Electronics*)

Answer **Q. Nos. 1, 2** and any **one** from the rest

1. Answer any *two* of the following : 2×2

   (*a*) Find the length of a half wave antenna suitable for transmission of a radio frequency signal of frequency 100 MHz.

(*b*) Explain the function of a duplexer.

(*c*) What is fading in radio wave propagation ?

(*d*) What is blind speed for the case of RADAR ?

2. Attempt any *two* of the following : 4×2

(*a*) Explain the operation of a double tuned discriminator with necessary circuit diagram.

(*b*) Draw the circuit diagram of an emitter coupled differential amplifier and derive the expression for its CMRR.

(*c*) Explain the method of generation of DSB-TC signal with necessary block diagram and necessary mathematical derivation.

(*d*) Write the advantages of FM over AM.

3. (*a*) Derive the expression for the refractive index of a homogeneous ionised gaseous medium when a radio wave propagates through it and find the expression for the critical frequency. $4 + 1$

(*b*) Define the terms : Sky wave, Skip distance, MUF. 3

4. (*a*) Suppose a sinusoidal information signal of frequency f_m frequency modulates a carrier wave of frequency f_c ($f_c >> f_m$). Derive the expression for the generated frequency modulated wave. Draw its waveform and find out the theoretical bandwidth of this generated signal. 1 + 1 + 3

(*b*) Differentiate between NBFM and WBFM. 3

PHS-104.2

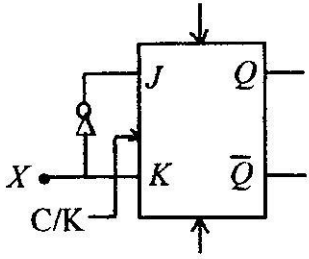
(*Digital Electronics*)

Answer **Q. Nos. 5**, **6** and any **one** from the rest

5. Answer any *two* questions : 2 × 2

(*a*) Convert 3-bit serial data into 3-bit parallel data.

(*b*) Give the excitation table of the following flip-flop



(*c*) Design a circuit with NAND gates which can generate high state only when two binary signals are equal.

(*d*) Give the circuit to produce
$A(A_1A_0) \times B(B_1B_0)$.

6. Answer any *two* questions : 4 × 2

(*a*) Solve the following equation by Karnough map :

$$Y = \pi\,(0, 1, 2, 3) \cdot d\,(8, 9, 10, 11)$$

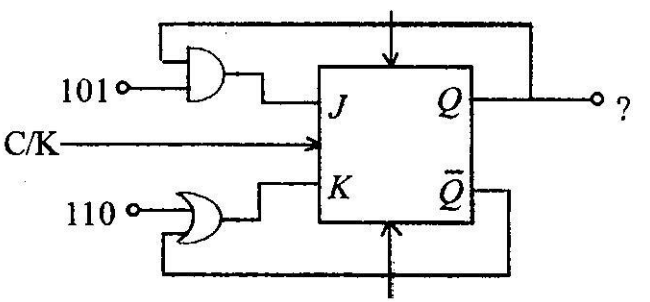
Write down the above equation in terms of SOP approach.

(*b*) Draw the circuit of 3 bit synchronous up/down counter and explain briefly.

(*c*) What do you mean by monostable multivibrator ? What is the use of it. Give the proper circuit diagram of it.

(*d*) Explain with proper circuit diagram the operation of 4-bit Twisted Ring Counter.

7. (*a*) Give the output of the following circuit after the three consecutive pulses. Assume $Q_0 = 1$.

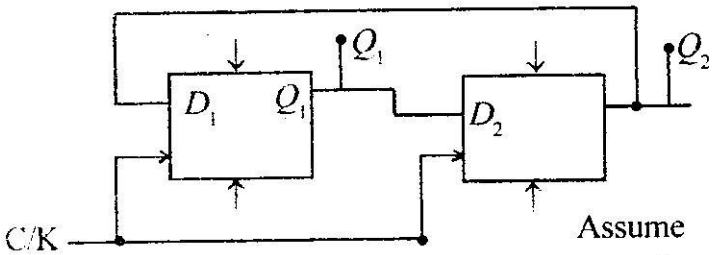


(*b*) Design a MOD-II circuit and give the waveform coming out from the different outputs of it.

(*c*) Give the truth table of a circuit which gives the square number of 3 bit binary input. 3 + 3 + 2

8. (*a*) Design a bi-directional 3-bit shift register.

(*b*) Explain the operation of the following circuit



Assume

$$\left.\begin{aligned} Q_1 &= 0 \\ Q_2 &= 1 \end{aligned}\right\} \text{ at } t = 0$$

(*c*) Give the truth table for the circuit which gives the following state digram. 3+3+2