2022

1st Semester Examination
PHYSICS

Paper : PHYS 104

Full Marks : 40   Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.

Paper : 104.1

(Analog Electronics)

(Attempt Q1, Q2 and any *one* from the rest)

1. Answer any *two* of the following questions :   2×2=4

   (a) What is fading in radio waves?

   (b) Define the terms : Tropospheric Waves, Sky wave propagation.

   (c) What is vestigial side band modulation and where it is used?
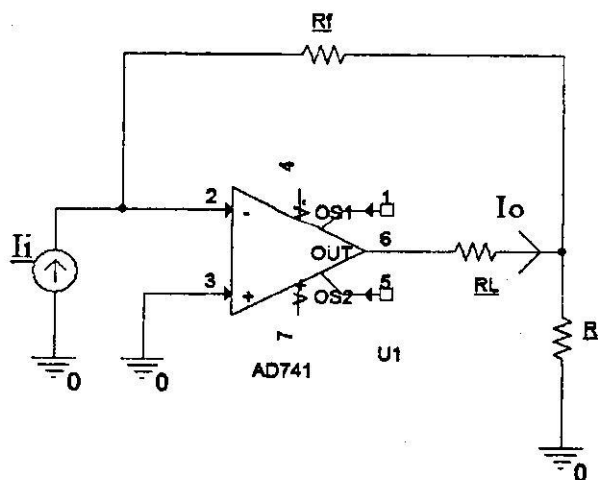
   (d) What is duplexer and where it is used?

P.T.O.

(2)

2. Answer any *two* of the following questions :   4×2=8

(a) Draw the circuit diagram of a balanced modulator and explain with necessary derivation how it can generate Double Side Band-SC signal.

(b) Derive radar range equation.

(c) Find out the expression for I_0/I_i in the following circuit :

(d) With necessary block diagram, explain the operation of a superheterodyne AM radio receiver. Write the value of intermediate frequency used in AM receiver.

3. (a) Suppose a sinusoidal carrier signal of frequency ω_c is frequency modulated by a sinusoidal modulating signal of frequency ω_m. Deriver the expression for the generated FM signal and hence find out the theoretical bandwidth of FM signal.

(b) State Carson's rule of thumb for the determination of bandwidth of FM signal.

(c) Explain any method of generation of FM signal.

4+1+3

4. (a) Derive the expression for the refractive index of ionosphere for radio waves, assuming it has a constant ionization density and hence show that it is less than 1. Hence define critical frequency in case of radio wave propagation through ionosphere.

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

5+3

Paper : 104.2

(Digital Electronics)

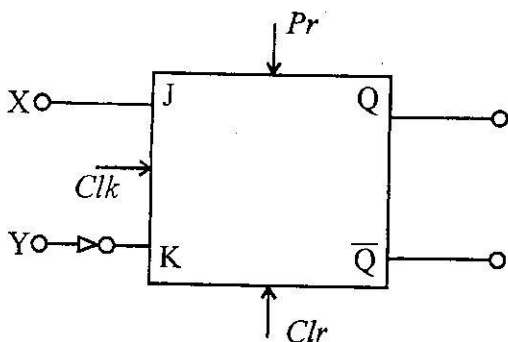1. Answer any *two* bits :

2×2=4

(a) Draw the circuit of 3-bit twisted ring counter and give the output states starting from 000.

(b) In a 4-bit digital system the input is BCD number and output goes high only when the input-equivalent number is a prime one. Right down the truth table.

(c) A 12 kHz clock pulse is given to a MOD-6 counter. Write down the different frequencies *coming out* from the different outputs of the counter.

P.T.O.

(d) Give the excitation table of the following flip-flop :

2. Answer any *two* bits :   4×2=8

   (a) What is astable multivibrator? Draw the circuit to produce a square wave of 5 kHz with 70% duty cycle.

   (b) Solve the following equation by K' map;

   $$Y = \sum m(0,2,10,16,18) + d(26,27)$$

   (c) Convert a T FF into a DFF.

   (d) Give the circuit of 2-bit bidirectional shift register. 4 KHz and 8 KHz signals are applied to a NAND gate. Draw the output waveform.   2+2

3. Answer any *one* bit :   8×1=8

   (a) (i) Draw the circuit of a 4 bit synchrounous down counter. Write down the state diagram of this counter.

(ii) Design a circuit for magnitude comparator of two binary signals $A(A_1 A_0)$ and $B(B_1 B_0)$.

4+1+3

(b) (i) What do you mean by Universal register? Give the circuit of a 2 bit Universal register and indicate the different mode of action.

(ii) How can you convert a parallel signal into a serial signal using register? 1+5+2

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