Total No. of printed pages = 5

63/2 (SEM-1) PHY 104

2021

(held in 2022)

PHYSICS

(Theory Paper)

Paper Code : PHY-104 (Old & New)

(Electronics)

Full Marks – 80

Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1×5=5

(a) What are the three terminal of the P type MOSFET ? 1

(b) The Propagation Constant $\gamma = \alpha + j\beta$. Name the constants α and β. 1

(c) Write down the expression relating phase angle and wavelength of a transmission line. 1

(d) What does reflections occur in a transmission line ? 1

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(e) A 100 MHz signal is passed over a wire of length 1 mm. Does this situation fulfills the criteria for transmission line ? 1

2. Answer any *five* of the following : 2×5=10

(a) Differentiate between D-MOSFET and E-MOSFET. 2

(b) Draw the block diagram of a voltage controlled oscillator and also draw the output waveforms of the oscillator. 2

(c) What is frequency stability of an oscillator ? Explain its significance. 2

(d) Draw the equivalent circuit diagram of a transmission line segment. 2

(e) Derive the Barkhausen criterion required for sinusoidal oscillation to be sustained with the help of block diagram of an oscillator. 2

(f) A 500 watt carrier wave is amplitude modulated to a depth of 60%. Find out the total in the wave. 2

(g) A phase shift oscillator is operating at f_0 = 10 KHz with R = 200 kΩ. Calculate the value of capacitance C of an R-C bridge circuit. 2

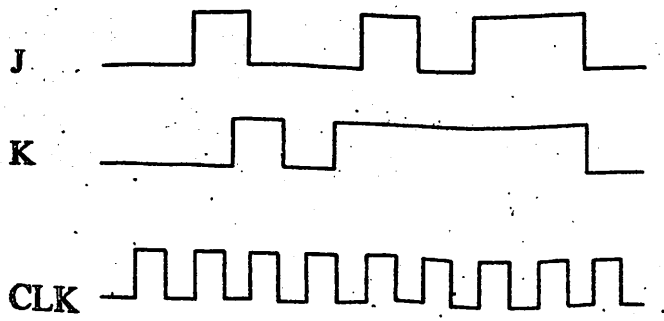
3. Answer any *five* of the following : 5×5=25

(a) Why noise appear in frequency modulation ? What are the pre-emphasis and de-emphasis process and how it works in reducing the noise ? 5

(b) Realize the following logic operations using only NOR gates : 5

(i) AND (ii) OR (iii) NAND.

(c) Draw the circuit diagram of the JK master-slave flip-flop and its truth table. Use it to obtain the output for the following signal : 5



(d) Build a 4-bit binary ripple up-counter using T-type flip-flops and show its count-up sequence. 5

(e) State the relation between standing wave ratio and reflection coefficient. 5

(f) Discuss the termination of a transmission line in three different ways 5

(i) Short circuited

(ii) Open circuited and

(iii) Load impedance equal to characteristic impedance

(g) Draw DTL circuit as NAND gate and explain its working. 5

4. Answer any *four* of the following : 10×4=40

(a) Derive the expression for a transmission line impedance and show that impedance varies point to point along the line. Show that input impedance on a line for repeats every half wavelength. 4+4+2=10

(b) Discuss why impedance matching is required for a transmission line. Establish a relation between stub line length and transmission line length required for proper matching of impedance. Why short circuited stub is preferred over an open circuited stub ? 3+6+1=10

(c) Define modulation index, frequency spectrum and bandwidth of a frequency modulated wave. What are advantages of FM over AM ? 8+2=10

(d) (i) Draw the circuit diagram of a first-order high-pass Butterworth filter and explain its operation from the voltage gain of the filter.

(ii) Draw the circuit diagram of Wien oscillator and explain its operation. 5+5=10

(e) Design a mod-5 synchronous counter systematically using J-K flip flops. 10