2018

CBCS

3rd Semester

PHYSICS

PAPER—C7T

(Honours)

Full Marks : 40

Time : 2 Hours

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.

Illustrate the answers wherever necessary.

Digital Systems and Application

Group—A

1. Answer any *five* quesitons : 5×2

(a) Draw the circuit diagram using diobe logic of AND gate and explain. 1+1

(b) Find the simple circuit which will compare two 1-bit number A and B and output = 1 for $A < B$ 2

(c) Find the decimal equivalent of 101.1101. 2

(d) A burglar alarm should activate when two conditions given below are simultaneously satisfied :

(i) the main entrance door is open and

(ii) the bed room door and/or the kitchen door is open.

Write the truth table and Boolean expression for the construction of logic circuit to operate the alarm. 2

(e) Design a 2 to 1 MUX using NAND gates only. 2

(f) Prove the identities : $\overline{A\overline{B}} + \overline{A} + AB = 1$ 2

(g) Define a register. Construct a 4 bit shift register using D-type flip-flops. (Block diagram only) 2

(h) What is Race-around conditions in JK Flip-Flop ? How can it be avoided ? 2

Group—B

2. Answer any *four* questions : 4×5

(a) Write down the Boolean function corresponding to the following standard sum of product notation :

$F(A, B, C) = \sum m(3,4,6,7)$ simplify the Boolean function by using Karnaugh map and Boolean algebra. 2+2+1

(b) (i) What is multiplexer? Design a 4 to 1 multiplexer using basic gates. 5

(ii) Realize $Y = \bar{A}B + \bar{B}\bar{C} + ABC$ using a 4 to 1 multiplexer. 1+2+2

(c) (i) Explain the operations of half subtractor using the necessary truth table, Boolean expression and logic circuit.

(ii) How can be realised a 4 bit parallel binary adder/ substractor? 2+3

(d) What is decade counter? Explain with the help of the relevant circuit diagram and truth table, the operation of a BCD decade counter. 1+4

(e) (i) What are the volatile and non-volatile memories in a microprocessor? 2

(ii) Find the base n if $7_n \times 8_n = 38_n$ 1

(iii) Two digital signals A = 0100110 and B = 0110011 are applied to the inputs of a 2 input EX-OR gate. Sketch the input and output signals. 2

(f) Draw the circuit diagram of a 4 bit register using D type flipflops and explain. Write down a table for readings of the shift register after each clock pulse by assuming data word 1011. 2+2+1

Group—C

3. Answer any *one* question : 1×10

(a) Draw the circuit diagram of an astable multivibrator using IC555 and explain its operation. Also draw the waveform at the output (PIN3) and across the capacitor (PIN 6) of the IC. Calculate the time period of the output waveform.

If a Capacitor $C = 0.01\text{mF}$ is used in the above circuit, Find the ratio of R_A and R_B to have duty cycle 1/3. [R_A & R_B is used as usual notation]

2+2+1+1+2+2

(b) (i) How does sequential logic system differ from combinational logic system ? 2

(ii) How is an R-S flip flop converted into J K flip flop ? Give its truth table and explain how it is obtained ? 4

(iii) How are the edge triggerered spikes generated ? 2

(iv) In the J-K flip flop $J = K = 1$. A1 MH_Z square wave is applied to its clock with $Q_0 = 0$. What are the period and frequency of the output waveform ? 2