

9. Construct a  $2 \times 3$  convolution algorithm using winograd algorithm with  $M(P) = P(P - 1) (P^2 + 1)$ . 14

**OR**

10. (a) Explain the steps in modified Cook Toom algorithm. 5  
 (b) Construct a  $2 \times 2$  convolution algorithm using Cook-Toom algorithm with  $b = 0, \pm 1$ . 9
11. (a) Explain steps of iterated convolution algorithm. 3  
 (b) Construct a  $4 \times 4$  linear convolution algorithm using  $2 \times 2$  short convolution. 10

**OR**

12. Construct a  $4 \times 4$  cyclic convolution algorithm using CRT with  
 $m(P) = P^4 - 1 = (P - 1) (P + 1) (P^2 + 1)$ . 13

**Faculty of Engineering & Technology**  
**Seventh Semester B.E. (EC/ET) (C.B.S.) Examination**  
**ELECTIVE—I : VLSI SIGNAL PROCESSING**  
 Time—Three Hours] [Maximum Marks—80

**INSTRUCTIONS TO CANDIDATES**

- (1) All questions carry marks as indicated.
- (2) Solve Question No. **1 OR** Question No. **2**.
- (3) Solve Question No. **3 OR** Question No. **4**.
- (4) Solve Question No. **5 OR** Question No. **6**.
- (5) Solve Question No. **7 OR** Question No. **8**.
- (6) Solve Question No. **9 OR** Question No. **10**.
- (7) Solve Question No. **11 OR** Question No. **12**.
- (8) Due credit will be given to neatness and adequate dimensions.
- (9) Assume suitable data wherever necessary.
- (10) Illustrate your answers wherever necessary with the help of neat sketches.
- (11) Use of non programmable calculator is permitted.

1. (a) Explain the structure of direct form FIR filter & data broadcast form FIR filter. Show that the data broadcast form can achieve a faster clock rate. 7
- (b) It is necessary to reduce the power consumption of a system by at least 5 times using pipelining. For the threshold voltage of 0.4 V and initial supply voltage of 5V, at what level should the system be pipelined ? What is the supply voltage of the pipelined system ? 7

**OR**

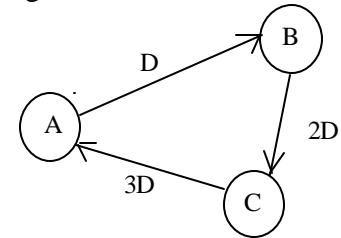
2. (a) How pipelining can be used to reduce power consumption ? Explain in detail. 7
- (b) Show that parallel processing reduces the power consumption of a system. 7
3. (a) What is retiming ? Explain the method of retiming which uses cutset in combination of slowdown. 6
- (b) Explain properties of retiming with example. 7

**OR**

4. Draw a constraint graph and use it to determine if the following system of inequalities has a solution and find a solution if one exists using Bellman-Ford algorithm. 13

$$\begin{aligned}
 r_1 - r_2 &\leq 0 \\
 r_3 - r_1 &\leq 5 \\
 r_4 - r_1 &\leq 4 \\
 r_4 - r_3 &\leq -1 \\
 r_3 - r_2 &\leq 2
 \end{aligned}$$

5. (a) Show that unfolding preserves the total no. of delays. 6
- (b) Perform Unfolding with unfolding factor  $J = 3$  for the given Figure 1. 7



**OR**

6. Describe how to design parallel processing architectures using unfolding. 13
7. (a) Explain the folding algorithm. 6
- (b) Explain life-time analysis for register minimisation. 7

**OR**

8. Consider a DSP program that performs transpose operation of  $3 \times 3$  matrix shown below.

Find :

- (1) Life time analysis
- (2) Data allocation using forward backward
- (3) Register minimization. 13

The matrix is :

$$\begin{bmatrix}
 a & b & c \\
 d & e & f \\
 g & h & i
 \end{bmatrix}$$