

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS-2023

M.Tech-I Semester [BT]

COURSE CODE (CREDITS): 18MI WBT133 (3)

MAX. MARKS: 25

COURSE NAME: Advances in Computational Systems Biology

COURSE INSTRUCTORS: Dr. Tiratha Raj Singh

MAX. TIME: 1 Hour 30 minutes

*Note: All questions are compulsory. Marks are indicated against each question in square brackets. Calculator is permitted.*

**Q1.** Discuss the significance of transcriptional regulatory networks through a 'real classical example' both in unicellular and multicellular organisms. [4]

**Q.2.** In a given biological network, it was observed that, 283 in total, 3 node motifs were found. Out of these; 5 types were 25 each, 3 types were 30 each and remaining 5 were 12, 17, 21, 10 and 8 respectively. Compute the subgraph concentration of each type and provide the justification for the significance of these motif types. [4]

**Q.3.** Classify the network motifs according to various families available. Which family is most significant in biological networks. Discuss this family in detail with real examples towards their logic gate based implementations. [5]

**Q.4.** Provide a technical discussion on following topics with reference to TRNs: [2\*4=8]

- (a) Erdos-Renyi model for Real and random networks (b) Boolean networks in TRNs  
(c) Transcription in E.coli: Time scale & Modularity (d) Bound activators and unbound repressors

**Q.5.** Realize the importance of Hill function for GRNs. For a given network, if maximal expression level is 5, Hill coefficient has the value 3.2, activation coefficient is 4 per unit and activator X is 2.5 which is half the amount of its active form. Calculate the Hill function for this activator X. [4]