Systems Thinking – Quiz 2 (Monsoon 2022) Time: 40 min

(course outcomes: CO-4 and CO-6)

1. Consider an FFL with AND - logic at the Z promoter with Sx activates X and Sy activates Y. More precisely the promoter logic is ((NOT X*) AND (NOT Y*)). Sketch the dynamics in response to ON step and OFF step of Sx in the presence of Sy. What is the response time for Z accumulation with respect to the time of addition of Sx (derive it) [5 marks]

Coherent type 3

2. If the regulator Y in coherent type 1 FFLs is positively auto-regulated. How does this affect the dynamics of the circuit, assuming that it has an OR input function at the Z promoter? Consider both an ON step and an OFF step [3 marks]

Coherent type 1

3. What is the temporal order of turn ON and turn OFF in a multi-output coherent type 1 FFL where all genes are regulated by AND gates? Which thresholds determine the ON and OFF orders? Can one obtain FIFO orders? [3 marks]
4. Explain the difference between (i) exons and introns, (ii) transcription and translation, and (iii) endocrine and paracrine signalling [3 marks]
5. Explain briefly how DNA is organized into genome [3 marks]
6. Derive the response time for NAR system [3 marks]