



Name: ..... Roll No.: .....

Branch: ..... Signature of Invigilator: .....

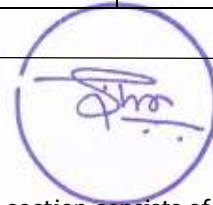
Semester: VIth

Date: 02/05/2022 (MORNING)

Subject with Code: BE415 SYSTEM BIOLOGY

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE



1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. Candidates should write their roll no. in each page of the booklet.
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to submit the question paper cum answer sheets before leaving the examination hall.

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**  
**(END SEMESTER EXAMINATION)**

**CLASS: BTECH**

**SEMESTER : VI**

**BRANCH: BIOTECHNOLOGY**

**SESSION : SP/22**

**SUBJECT: BE415 SYSTEMS BIOLOGY**

**TIME:**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The missing data, if any, may be assumed suitably.
  2. Before attempting the question paper, be sure that you have got the correct question paper.
  3. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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**Q. Answer the following–**

**[30 X 1 = 30]**

1. The interaction between transcription factors and genes is described by:
  - a. Transcription networks
  - b. Sensory networks
  - c. Developmental networks
  - d. None
2. Modular networks make transcription networks:
  - a. Evolvable
  - b. Sensitive
  - c. Both
  - d. None
3. Higher the value on 'n' in a Hill function the closer the response to a
  - a. Step function
  - b. Gradual response
  - c. Both
  - d. None
4. A two input function with a positive true value, only when both inputs are true can be represented by a
  - a. NOT gate
  - b. NOR gate
  - c. AND gate
  - d. XOR gate
5. Negative autoregulation promotes\_\_\_\_\_ to fluctuations in production rate:
  - a. Robustness
  - b. Modularity
  - c. Sensitivity
  - d. None
6. How many possible ways are there to connect three nodes with directed arrows?
  - a. 8
  - b. 13
  - c. 13

- d. 18
7. The overall sign of interaction in an indirect path of FFL is determined by \_\_\_\_\_ the signs:
- ANDing
  - ORing
  - NOTing
  - NANDing
8. Which of the following statements is true?
- There is a delay following ON step in FFL
  - There is no delay following OFF step in FFL
  - Both
  - Cant say
9. An ON pulse that is shorter than delay time  $T_{on}$  does not lead to gene expression:
- True
  - False
10. Which of the following statements is TRUE about SIM?
- A master transcription factor controls a group of genes
  - It can generate temporal gene expression programs
  - Both
  - None
11. The lambda repressor switch consists of:
- CI protein activating lysogeny
  - Cro protein activating lysis
  - Both
  - None
12. The chemical systems may behave in a digital manner if \_\_\_\_\_ is high in a ligand binding
- Co-operativity
  - Objectivity
  - Repressibility
  - None
13. Random variability arising in cellular biology is known as:
- Noise
  - Chaos
  - Both
  - None
14. Michaelis constant is the \_\_\_\_\_ concentration at which the reaction reaches half of maximum velocity
- Substrate
  - Enzyme
  - Transcription factor
  - Protein
15. Temporal order depends upon:
- Threshold concentration
  - Cell size
  - Synaptic transmission

- h. None
16. Which of the following statements is true?
- e. Neuronal circuits have faster response time
  - f. Sensory networks work on molecular and cell size level
  - g. Developmental networks may span upto years
  - h. All
17. Which of the following ffl has all direct and indirect signs same ?
- e. C1 FFL
  - f. I1 FFL
  - g. I2 FFL
  - h. BOTH A AND C
18. A double positive feedback loop regulating a gene z has how many steady states?
- e. 2
  - f. 3
  - g. 4
  - h. 1
19. Gram-negative bacteria produce \_\_\_\_\_autoinducers that can passively diffuse through their thin cell wall.
- a. acyl-homoserine lactone
  - b. 4 -5 methyl acyl-homoserine lactone
  - c. Acetyl Co-A
  - d. None of the above
20. For Biofilm production *V. cholerae* regulates its response to autoinducers via following gene
- a. LuxO~PO<sub>4</sub>
  - b. LuxO
  - c. LuxI
  - d. None of the above
21. For cell-cell communication in the marine bacterium *Vibrio fischeri* following gene system is responsible
- a. LuxO/LuxR system
  - b. LuxI/LuxR system
  - c. LuxI only
  - d. None of the above
22. In the process of developmental stages of *Drosophila melanogaster*, the stage of “Body Segmentation” comes after the
- a. Fertilization
  - b. Cleavage
  - c. Gastrulation
  - d. Midblastula Transition
23. The slowdown of nuclear division and the concomitant increase in RNA transcription happened in the developmental stage of
- a. Fertilization
  - b. Blastoderm Formation
  - c. Gastrulation

- d. Midblastula Transition
24. A cDNA microarray consists of a collection of cDNA fragments which are \_\_\_\_\_ of gene transcription products (mRNA).
- chemically synthesized oligo DNA
  - forward transcripts
  - reverse transcripts
  - None of the above
25. In the One-color method microarray, Target samples a and b are labeled with one type of dye in the one-color method. Then each sample is hybridized on \_\_\_\_\_ DNA microarray.
- separate
  - same
  - four types
  - None of the above
26. In the website National Center for Biotechnology Information (NCBI), gene sequences are available on GEO profile. The full form of GEO is
- Gene Expressed Orthologous
  - Gene Expression On-site
  - Gene Expression Omnibus
  - None of the above
27. In the Indirect Labelling of microarray: In the indirect procedure, a reactive group, usually a primary amine, is incorporated into the \_\_\_\_\_ first, and the Cy3 or Cy5 is then coupled to the cDNA in a separate reaction.
- mRNA
  - cDNA
  - protein
  - None of the above
28. Following which method is not used in microarray Spotting
- Photolithography
  - Ink-jet printer microarrays
  - spotted arrays on glass
  - Chemical etching
29. The latest release of Systems Biology Markup Language (SBML)
- SBML Level 3 Version 4 Core
  - SBML Level 3 Version 2 Core
  - SBML Level 4 Version 2 Core
  - None of the above
30. Following which is not a purpose of SBML:
- enable the use of multiple software tools without having to rewrite models to conform to every tool's idiosyncratic file format

- b. enable the use of single software tools without having to rewrite models to conform to every tool's idiosyncratic file format
- c. ensure the survival of models beyond the lifetime of the software used to create them.
- d. None of the above

**Q. Answer the following–**

- Q.1 Compare and contrast the Lac and Tryptophan operon models of gene control. [2]
- Q.2 What is Quorum Sensing? How *V.cholerae* regulates its response to autoinducers via LuxO gene? [2]
- 3 Explain the switch like behaviour in co-operative binding using the Hill equation and graph. [2.5]
- 4 “The C1-FFL is a sign sensitive delay element”- Discuss this statement. [2.5]
- 5 Enlist the sources and effects of intrinsic and extrinsic noise. [2]
- 6 Write two advantages of futile cycles. [2]
- 7. Write the working principle of two-color DNA microarrays, illustrate with example? [2.5]
- 8. What is direct and indirect labeling in microarrays? [2.5]
- 9. What are different components and levels of Systems Biology Markup Language (SBML)? [2]

:::::02/05/2022:::::