**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE PILANI HYDERABAD CAMPUS**

First Semester 2022-2023

**Cell Biology (BIO F213)**

Comprehensive Exam

Total Marks: 80 22-12-2022 3h

### Part A : Closed book 40 marks

1.a) Apoptosis is essential for us. Elaborate. **(3M)**

 b) The same signaling molecule may have different effects depending on which is the target. Elaborate with an example. **(2M)**

 c) Can a signalling molecule act as a molecular switch? Explain in detail with example. **(3M)**

2.a) State whether the given statement is True or False **(2M)**

i) Enzymes needed for glycolysis are seldom found attached to the microtrabecular lattice.

ii) Desmin is a class of carbohydrate molecule associated with intermediate filaments in muscle cells.

iii) Microtubular growth primarily utilizes GTP hydrolysis.

iv) Phalloidin is an actin specific drug that binds and stabilizes microtubules.

b) Match statements from set A correctly to those in set B **(4M)**

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| --- | --- |
| Set A | Set B |
| 1. Site specific binding of aminoacyl-tRNA | a. 23S and 5S RNAs |
| 2. Large ribosomal subunit | b. 30S and 50S subunits |
| 3. Ribosomal monomer in karyotes | c. mRNA codon |
| 4. Tightly binds the P-site of small ribosomal subunit  | d. Charged initiator tRNA |

c) Fill in the blanks **(2M)**

The mitotic phase has two phases, mitosis and \_\_(i)\_\_\_\_. Between phases of \_\_(ii)\_\_\_\_, we have interphase that is made up of the S phase. The overall length of cell cycle can be determined easily by finding out the time in which the cell population \_\_\_(iii)\_\_\_. Throughout cell cycle, each step is carefully controlled by a class of enzymes termed \_\_(iv)\_\_\_\_\_.

3. Write short notes on **any three** the following with figures wherever applicable(3x4=**12M**)

a. The working of the sodium-potassium exchange pump

b. SNAREs proteins and their mechanism of action

c. F-factor and its role in bacterial conjugation

d. Effect of Akt signaling on cell growth

4. Despite the presence of multiple signaling pathways in our body pertaining to a range of biochemical processes, it is true that they are deeply interconnected. Give your views on this statement with proper justification. (**5M**)

5. a) Explain the term density dependent inhibition. Explain ways you can avoid it when culturing cells. **(3M**)

b) What is a synchronous culture? List and explain briefly the different ways in which one might acquire a synchronous culture. (2+2=**4M**)

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### Part B: Open book 40 Marks

1. You have treated a cancer cell line B16 (mouse melanoma) with a drug termed D which has its inherent fluorescence. It has been told to you that this drug D induces cell cycle arrest. Formulate a detailed experimental work flow which would include the methodology you would adapt (and why) to do the following-

a. Physical/Morphological characterization of effect of drug on cells. (**3M**)

b. Ascertaining entry of drug into cells upon treatment. (**3M**)

c. Ascertaining whether drug has worked as expected or as theorized. (**3M**)

Include flowcharts/detailed instrumentation use wherever and however best applicable.

2. a. Contact dependent signaling is often crucial for organismal development. Elaborate with a suitable example. (**3M**)

b. You have a drug B which you know is a phosphatase (removes phosphoryl groups). Could such a phosphatase be used to treat cancer cells with RTK overexpression? State your opinion on this matter with your reasons. (**4M**)

c. What is maturation promoting factor? What is the nature of its interplay with cyclin during mitosis? Explain in detail. (**4M**)

3. a. Polayamines are well known ion chelators. Could these possibly affect synaptic signal transmission? State your answer with supporting points and diagram wherever applicable. (**5M**)

b. Coffee is high on caffeine content and hence acts as a stimulant. Explain in detail how cAMP activity is involved in this day-to-day phenomenon.(**5M**)

4. a. Cancer cells are often characterized by mutations in the genes pertaining to the Bcl2 protein family. Explain with proper mechanism as to how this might be advantageous for cancer cells and their survival. (**5M**)

b. Describe the experiment performed by Frye and Edidin to prove protein mobility in the lipid bilayer. (**5M**)