

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**  
**BIO G 512 (Molecular Mechanism of Gene Expression)**  
**FIRST SEMESTER 2016-17 Comprehensive Examination**  
**PART-B (Open Book)**

**MM: 30 M**

**Date: 01.12.16**

**Max Time: 1 hr**

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**Note- Each question carry 6.0 Marks**

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1. Site specific mutagenesis was used to replace either tyrosine 15 or tyrosine 19 in the cell cycle regulatory protein *pp34*, the product of gene *cdc 2* of *Schizosaccharomyces pombe*, with a phenylalanine residue. The 2 *cdc2* mutants alleles that were produced have been referred to as *cdc Phe 15* and *cdc 2 Phe 19*, respectively. Phenylalanine is structurally very similar to tyrosine, but is not subject to phosphorylation by protein kinase as is tyrosine. What effect(s) if any would you expect these modified *cdc2* alleles to have on the cell cycle of the cells carrying either (a) *cdc Phe 15* or (b) *cdc 2 Phe 19* in the homozygous or hemizygous (haploid) state?
2. When “multigenic” mRNAs transcribed from bacterial operons are translated, equimolar quantities of each polypeptide chain encoded by the message are synthesized in the case of *trp* and *gal* operon mRNAs of *E.coli*. When *lac* operon mRNA is translated, however, the enzyme  $\beta$ -galactosidase is synthesized three or five times more frequently than the transacetylase enzyme. In what region(s) of the *lac* operon mRNA would you look for sequence that might explain this discrepancy?
3. You wish to learn which mRNA sequences are “shielded” from nuclease digestion when mRNA first associates with ribosomes. Outline how you would perform this experiment. Which nucleotides would you predict would be shielded in prokaryotes? Eukaryotes? [4.0]
4. What are self-splicing introns? How do their chemical mechanisms compare to pre-mRNA splicing? How are tRNA introns related to other intron types?
5. How does processing of Pol I and Pol III transcripts differ from processing of Pol II transcripts? What are the snoRNA?

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**FIRST SEMESTER 2016-17**

**Comprehensive Examination**  
**PART- A (Closed Book)**

**MM: 50 M**

**Date: 01.12.16**

**Max Time: 2 hr**

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- A. The exam is divided into Part-A (Close-book) and Part-B (Open-book).
  - B. You are now having Part-A of the question paper, Maximum time 2h.
  - C. Attempt all questions of each section together.
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1. How could you determine which polymerase transcribes a particular gene? (Hint: drugs + method to specifically detect the transcript of that gene) (6.0 Marks)
2. What characteristic of TFIIF make the protein important for transcriptional initiation and elongation? Why? (6.0 Marks)
3. Several cases are known in which a single molecule regulate the synthesis of different proteins encoded in the distinct mRNA molecules 1 & 2. Give a brief possible molecular explanation for each of the following observations made when the effector is absent.
  - (a) Neither nuclear nor cytoplasmic RNA can be found that hybridizes to either of the genes encoding the molecules 1 & 2.
  - (b) Nuclear but not the cytoplasmic RNA can be found that hybridizes to the genes encoding molecules 1 & 2.
  - (c) Both nuclear and cytoplasmic RNA but not polysome associated RNA can be found that hybridizes to the genes encoding molecules 1 & 2. (2.0 Marks each)
4. Abbreviate the following terms and mention their role- (8.0 Marks)
  - (a) St RNA
  - (b) pi RNA
  - (c) rasi RNA
  - (d) ago proteins
  - (e) CI
  - (f) H2AZ
  - (g) PQ
  - (h) bHLH
5. (a) How does a riboswitch function in GlcN6P ? Explain with a suitable diagramme.  
(b) Protein splicing is “autocatalytic” Explain this statement with suitable example. (6.0 Marks)
6. Explain in brief the mechanism of action of positive regulatory activators. (6.0 Marks)
7. What are the main steps required for lambda phage to enter and maintain lysogeny. Give a schematic diagramme to explain. (6.0 Marks)
8. What’s an insulator? What are its Function(s) and Properties? How does it work? (6.0 Marks)