Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(BT)/SEM-3/MBT-306/2011-12

2011

GENOINFORMATICS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any *five* from the rest.

1. A) Fill in the blank : 1

   i) The LOD score is a statistical test used for ..... .

   B) Answer very briefly the following question : 1

   ii) Name a program that uses hexamer frequency as a characteristic for intrinsic content for the prediction of genes.

   C) State whether the following statements are True or False : 8 × 1 = 8

   iii) Pseudogenes are functional relatives of known genes that have retained their protein coding ability.

iv) With special reference to the kinetics of DNA renaturation, the Cot values increase with increased genome complexity.

v) More complex organisms (eukaryotes) have increased gene density in comparison to prokaryotes.

vi) Genetic complexity is inversely proportional to the content of non-repetitive DNA.

vii) NetGene2 is a program for splice-site detection.

viii) Success rate for gene identification in eukaryotes is 99% compared to that of prokaryotes which is 55%.

ix) Creation of the new gene — jingweii, destroyed previous function.

x) In a chimeric protein, regulatory regions can be from both the portions of the gene.

2. Define extrinsic content sensor. Mention the different sequence types in it. Mention the strength and weakness of extrinsic content sensors. 2 + 4 + 2 + 4

3. a) What is PWM ? How is it different from PSSM ? Where would you expect PWMs to be used ? 2 + 2 + 2

   b) Mention the set of properties that correctly predicted gene structures are checked for. 3

   c) "The number of potential gene models grows exponentially with the number of predicted exons." Explain. 3

4. Explain what is meant by intron phase. How many types of intron phases are there ? What are the basic differences between an intron phase and an exon phase ? Describe how can the intron-late or the intron-early model be established studying intron phases. 2 + 3 + 2 + 5

5. a) What is codon bias ? What is RSCU ? Define CAI. 2 + 2 + 2

   b) Write down the various mechanisms by virtue of which new genes are formed. 6

6. a) What factors determine the reassociation kinetics of a pair of complementary DNA sequences ? 3

   b) With special reference to DNA complexity, make a comparison between two genomic DNA samples of same concentration but of different genome sizes. 3

   c) In the context of evolution, exon shuffling leads to increased variation in species. Explain. 5

   d) Give two examples of multigene families. 1

7. a) What is genetic drift ? Explain with a suitable example. 2

   b) What is N_e ? Explain how would smaller N_e lead to genome complexity. 3

   c) What are transposable elements (TEs) ? Classify TEs according to their mode of transposition. 4

   d) What do you understand by autonomous and non-autonomous TEs ? 3

8. a) "TEs are likely the major forces driving changes (both expansion and reduction) in genome size during primate evolution." Explain. 5

   b) Define heterochrony with special reference to *C. elegans*. 5

   c) Enumerate the roles of *lin-4* or *let-7* miRNAs in *C. elegans* development. 2

9. a) What is meant by "Horizontal Gene Transfer (HGT)" ? State its contribution in evolution. 4

   b) Briefly describe the mechanism of HGT in prokaryotes. 4

   c) Distinguish between "forward genetics" and "reverse genetics" with special reference to *C. elegans*. 4