Total number of printed pages – 7 B. Tech CPBT 7204

Fourth Semester Examination – 2008

MOLECULAR BIOLOGY

Full Marks – 70

Time: 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.

The figures in the right-hand margin indicate marks.

- 1. Answer the following questions : 2 × 10
 - (a) What is Shine Dalgarno Sequence ?
 Mention the function of this sequence during translation.
 - (b) What is the function of Alkaline Phophatase and Taq DNA polymerase in molecular biology ?
 - P.T.O.

- (c) "Genetic code is degenerate" Explain with suitable examples.
 - (d) An *Hind-III enzyme* has cleaved a genomic DNA of 4.32 ×10³ bp by incubating at 37 °C for 2 hours. The GC content of the genome is 50%. Calculate the frequency of restriction cleavage and number of restriction fragments generated at the end of this experiment assuming it a complete digestion.
 - (e) Differentiate between '*rho*-dependent' and '*rho*-independent' termination of transcription.
 - (f) How many number of targeted DNA fragment will be generated by using PCR amplification of 30 cycles, where the initial copy number of template DNA is 6×10^{6} and mean efficiency of PCR is 90% ?

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Contd.





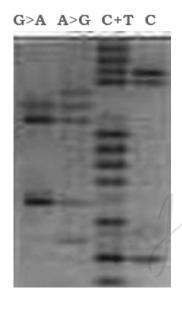
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- (g) Why DNA is known as the genetic material ? Name two evidences deliberated to show DNA is the genetic material.
- (h) An oligo-nucleotide probe of 50 bp length and 54% GC content was synthesized using a DNA synthesizer. The post synthesis optical density measurement of probe was 1.082 at 260 nm. Calculate the oligonucleotide concentration of the probe.
- (i) Transcription and translations are coupled in prokaryotes, but not in eukaryotes – explain the reason thereof.
- (j) Define '*Tm*' of DNA. Calculate the '*Tm*' of a 15-mer primer containing 40% GC content.

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- (a) What do you mean by c-DNA and how it differs from genomic DNA ? Briefly explain the various approaches used to generate c-DNA molecule during construction of C-DNA library. 2+5
 - (b) How many number of c-DNA clone is required for 99% coverage of the genome, if the cloning vector is BAC and genome size is 6×10^6 mbp. 3
- What is Transcription ? Briefly explain the process of transcription in eukaryotes and add a note on transcription factor II-D (TFII-D).
 1+6+3
- 4. (a) Briefly explain the Sanger's method of DNA sequencing. How this method was automated for the sequencing of sub-genomic YAC clones ? 4+2
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 (b) The following is a part outcome autoradiogram of Maxam and Gilberts sequencing experiment. During the experiment the radioisotope labelled with 5' end.
 What is the sequence including polarity of the SS-DNA that served as template for generating this pattern.



5. (a) Briefly explain the methods of nucleic acid hybridization. Add a note on the stringency of hybridization.
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- (b) Define genome complexity. Narrate the genome composition of human with note on repetitive DNA.
- 6. (a) Briefly explain the properties and mode of action of Restriction-modification system-II and justify the importance of Restriction endonuclease-II enzyme in recombinant DNA experiments.
 - (b) A circular plasmid DNA molecule of size 10.5 Kbp is digested with restriction endonucleases – *Eco R-I, Hind-III* and *BamH-I*, singly and in all possible combinations. Linear restriction fragments of following sizes are generated :

| <u>Enzymes</u> | <u>Fragment size in kbp</u> | |
|---|-------------------------------|--|
| Eco R-I | 10.5 | |
| Hind-III | 5.1, 3.4, 2.0 | |
| BamH-I | 7.3, 3.2 | |
| Eco R-I + Hind-III | 4.0, 3.4, 2.0, 1.1 | |
| Eco R-I + BamH-I | 6.7, 3.2, 0.6 | |
| Hind-III + BamH-I | 4.6, 2.7, 2.0, 0.7,0.5 | |
| Eco R-I + Hind-III + BamH-I | 4.0, 2.7, 2.0, 0.7, 0.6, 0.5. | |
| Sketch a restriction map of the plasmid | | |

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|-----------------------|---|--------|
| using the above data. | | 6 |

- 7. (a) How does RNA editing contribute to protein diversity in eukaryotes ? What roles do guide RNA play in RNA editing ? 5
 - (b) What is Attenuation ? What role it plays in gene regulation of tryptophan operon in *E. coli* along with repression ? 5
- Write down short notes on any *two* of the following : 5×2
 - (a) Cosmid as cloning vector.
 - (b) Enzymes involved in eukaryotic DNA replication.
 - (c) Post transcriptional gene silencing.

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