

BITS PILANI DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY
FIRST SEMESTER 2011-20112
Compre exam Date: 07.1.2012

CourseTitle: Genetics
Maximum Marks: 40

Course NO: BIOT C332
Duration: 3 hours

Attempt all the questions in the given sequence

- Q1a. What are the events that occur at the origin of DNA replication? [2]
- b. Suppose in a strain of soybeans, high oil (H) content in the seeds is dominant to low oil content and four seeds (E) in a pod is dominant to two seeds in a pod. A farmer crosses two soybean plants, both with high oil content and four seeds per pod. The resulting F1 offspring have a phenotypic ratio of 9:3:3:1 (High oil / four seeds : High oil / two seeds : Low oil / four seeds : Low oil / two seeds). [1+1+1]
- What genotype were the parent plants?
 - Suppose the farmer chooses two of the high oil / four seed plants and crosses them. The F2 generation have all high oil / four seed phenotypes. What were the genotypes of the plants chosen by the farmer to cross?
 - Which known genotype might the farmer cross her high oil / four seed plants with to determine their genotype?
- c. Explain the nucleotide excision repair mechanism. [3]
- d. How can we obtain purified double stranded DNA for gene cloning? [2]
- Q2a. Within a population of butterflies, the color brown (B) is dominant over the color white (b). And, 40% of all butterflies are white. Given this simple information, which is something that is very likely to be on an exam, calculate the following: [3]
- The percentage of butterflies in the population that is heterozygous.
 - The frequency of homozygous dominant individuals.
- b. What is the energy requirement for making a 10 amino acid peptide in prokaryotes? [5]
- c. How does the *cl* gene control its own concentration in the cell? [2]
- Q3a. A violet-flowered, long-stemmed plant was crossed with a white-flowered, short-stemmed plant, producing the following offsprings
- 47 violet, long-stemmed plants
 - 40 white, long-stemmed plants
 - 38 violet, short-stemmed plants
 - 41 white, short-stemmed plants
- What is your hypothesis about the genetic control of the phenotype? Does the data support this hypothesis? (given: critical chi square at $p = 0.05$ is 3.841) [3]

b. Explain the Combinatorial control of RNA polymerase II in eukaryotic transcription. [4]

c. Define: i. Somatic hypermutation, ii. Somatic crossing over, iii. F-duction [3]

Q4a. What are the Phenotypic and Genotypic effects of transposition? [2]

b. Explain with an example the existence of the non Mendelian inheritance. [3]

c. What are the two classes of proteins involved in chromatin remodeling? [2]

d. The general transducing phage P1 was grown on a wild-type bacterial strain (*cys⁺ pyr⁺ trp⁺*). The resulting phages were mixed with bacteria which require cysteine, uracil, and tryptophan (*cys⁻ pyr⁻ trp⁻*). Recombinants were selected on medium containing uracil and tryptophan. The results are below. [1+1+1]

Phage and cells added	Number of colonies
Phage only control (10^8 phage)	0
Cells only control (10^8 cells)	4
Phage (10^8) + Cells (10^8)	200

- Why were there no colonies on plates with phage only?
- What was the likely source of the four colonies on the plate with recipient cells only?
- What is the predicted genotype of these four colonies?

BITS PILANI DUBAI CAMPUS
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FIRST SEMESTER 2011-20112
Test 2 (OPEN BOOK)

Course NO: BIOT C332
CourseTitle: Genetics

Maximum Marks: 20
Duration: 50mins

Date: 04.12.2011

Attempt all the questions in the given sequence

1. Three linked loci, ABC (linked in this order) show the following recombination frequencies: A - B 5%, B - C 25%, A - C 30%. 1000 individuals are measured and 5 double-recombinants are observed.
 - a. What is the coefficient of coincidence for A - C? [2]
 - b. What is the interference? [1]

2. An ABC/abc individual (ABC is not necessarily in the gene order) is crossed to an abc/abc individual and gametes are scored. Out of a total of 1000 gametes from the ABC/abc, we observe ABC 382; ABc 8; abc 395; abC 9; Abc 98; AbC 2; aBC 105; aBc 1. Using this data, compute the recombination frequencies for all pairs of loci and determine the correct gene order. [4]

3. The index of co-occurrence is inversely proportional to the map distance. Justify. [2]

4. Why is a Hfr more efficient in recombination? [2]

5. An *E.coli* strain that is *tyr⁺ pro⁺ val⁺* is used as a donor, and *tyr⁻ pro⁻ val⁻* as the recipient. Initial transformants are isolated on minimal medium + proline + valine. [5]
 - a. What genotypes will grow on this medium?
 - b. The colonies obtained in 'a' are replicated to minimal medium + proline and 70% of the original colonies grow. What genotypes will grow on this medium?
 - c. The original colonies obtained in 'a' are also replicated to minimal medium + valine and 5% of the colonies grow. What genotypes will grow on this medium?
 - d. The original colonies obtained in 'a' are replicated to minimal medium. No colonies grow. From this information, what genotypes will grow on minimal medium + proline and minimal medium + valine?
 - e. Based on this information, which gene is closer to *tyr*?

6. Generalized transduction is preferred over specialized transduction? [2]

7.
 - a. How would you confirm the occurrence of a transposition event? [1]
 - b. What is the significance of the leader peptide in the control of the *trp* operon? [1]

**BITS PILANI DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY
FIRST SEMESTER 2011-2012
TEST – I (CLOSED BOOK)**

**Course No.: BIOT C332
Course Title: Genetics**

09.10.11

**Maximum Marks: 25
Maximum Time: 50 minutes**

Attempt all the questions in the given sequence

- Q1. Explain the alternative forms of DNA. [3]
- Q2. Explain the Hershey Chase experiment. [4]
- Q3. Diagrammatically explain the rolling circle model of DNA replication. [3]
- Q4. Suggest an experiment to prove that the DNA acts as a template for RNA synthesis. [3]
- Q5a. Explain the terms: i. downstream, ii. Hogness box, iii. splisosomes [3]
- Q5b. Give any two examples of unusual bases found in a tRNA. [2]
- Q6. Explain the steps involved in initiation of transcription in eukaryotes. [4]
- Q7. What are terminators? How do they work? [3]

BITS PILANI DUBAI CAMPUS
FIRST SEMESTER 2011-2012
QUIZ- 2 (CLOSED BOOK)

Course No.: BIOT C332

23.11.11

Maximum Marks: 07

Course Title: Genetics

Maximum Time: 20 minutes

NAME:

ID No.

1. What is recombinant DNA technology? [1]
2. What are the different ways in which restriction endonucleases work? Give one example of each type of enzyme and mention their source organism. [2]
3. What are *cos* sites? Give their significance. [1]

4. Why are plasmids with two antibiotic markers preferred over plasmids with one antibiotic marker? [1]

5. What is the role of NaOH in southern blotting? [1]

6. What is biological transfer of DNA? [0.5]

7. What is variable number of tandem repeats (VNTR) locus? [0.5]

Name:

ID No:

**BITS PILANI DUBAI CAMPUS
FIRST SEMESTER 2011-2012
QUIZ- I (CLOSED BOOK)**

**Course No.: BIOT C332
Course Title: Genetics**

26.10.11

**Maximum Marks: 08
Maximum Time: 20 minutes**

1. Define mutation rate. [1]
2. Name the enzyme that helps in attaching the specific amino acid to the respective tRNA. [1]
3. Give two examples of chemicals that give rise to transition mutations. [1]
4. Explain the formation of the initiation complex in prokaryotic translation. [2]
5. What is intergenic suppression? [1]
6. What is the role of RecA protein? [1]
7. What is the Shine Delgarno hypothesis? [1]