THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME – LEVEL 04

FINAL EXAMINATION – 2010/2011

BOTANY

BTU 2102/BTE 4102/BTI 4102 – GENETICS, EVOLUTION & INTRODUCTORY MOLECULAR BIOLOGY

DURATION : TWO (02) HOURS

DATE : 22nd December 2010 TIME : 1.00 – 3.00 p.m.

ANSWER **FOUR (04)** QUESTIONS SELECTING AT LEAST **ONE (01)** FROM EACH PART

PART A

1.

A) What is gene linkage?

B) A study was conducted on three linked genes in wheat.

C/c - coloured Vs colourless (absence of anthocyanin) grains.

R/r - round Vs oval grains.

W/w - non-waxy Vs waxy leaves

A test-cross involving triple recessives and F_1 plants heterozygous for the three gene pairs gave the following phenotypes in the progeny.

Colourless, oval, non-waxy	-	216
Coloured, round, non-waxy	-	104
Coloured, oval, non-waxy	-	2638
Coloured, oval, waxy	-	701
Colourless, round, non-waxy	-	726
Colourless, round, waxy	-	2808
Colourless, oval, waxy	-	102
Coloured, round, waxy	-	213

i) Give the genotypes of the progeny given above.

ii) Explain the gene order and how the three genes were originally linked in the tri-hybrid parent.

iii) Estimate the distance between the genes.

2.

A) Briefly explain the different types of epistasis observed.

B) Two white flowered strains of *Lathyrus odoratus* were crossed, producing an F_1 with only purple flowers. Random crossing among the F_1 produced 96 progeny plants, 53 exhibiting purple flowers and 43 with white flowers.

i) What phenotypic ratio is illustrated by the F_2 ?

ii) What type of interaction is involved ?

iii) What were the probable genotypes of the parental strains ?

3.

A) Explain the following very briefly with examples

(a) Dominance
(b) Partial (incomplete) dominance
(c) Co-dominance

B) In cats, females homozygous for the dominant *B* allele are black and *bb* homozygous are orange. When black and orange cats are mated, the female progeny are always 'tortoise-shell' and their coats show a mottling of small black and orange patches, while the male progeny have the same coat colour as their mother. Only very rarely are male tortoise-shell cats found.

i) How do you explain these results ?

PART B

4.

A) DNA of the bacteriophage T_2 contains 3×10^5 base pairs. (The molecular weight of T_2 is 1.5×10^8). How many genes of average size (encoding proteins of about 40,000 molecular weight) can this phage contain ?

Assume : The average molecular weight of an amino acid is 100.

B)

Nucleic acids isolated from four different species had the following base ratios (%) :

Species	A	T	U	G	C	$\frac{A+T \text{ (or } A+U)}{G+C}$	$\frac{A+G}{C+T \text{ (or } C+U)}$
1	17	17	-	33	33	0.5	1.0
2	29	19	-	22	30	0.97	1.0
3	24	–	16	24	36	0.66	1.0
4	-	34	-	-	-	2.1	1.0

For each species state whether,

(i) the nucleic acid is DNA or RNA

(ii) it is single-stranded or double-stranded

5. Write an essay on 'Human evolution'.

6. Write short notes on **any two** of the followings:
   a. Hardy-Weinberg Law
   b. Speciation
   c. Post mating reproductive isolating mechanisms
   d. Plate tectonic theory