M.Sc. 1st Semester Examination, 2015

ZOOLOGY

PAPER — ZOO-104(Gr.-A and B)

Full Marks : 40

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate marks

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

Illustrate the answers wherever necessary

GROUP – A

(*Immunology*)

1.   Answer any *two* questions of the following :   2 × 2

(*a*) "Haematopoietic Stem Cells (HSC) are designated as multipotent cells"— Explain.

(b) What are the most hypervariable domains of class I MHC and class II MHC ?

(c) Explain the term sensitivity and specificity of the ELISA test.

(d) What do you mean by titer ?

2. Answer any *two* questions of the following :   4 × 2

(a) Define Adjuvant. State its mode of action.   1 + 3

(b) Distinguish between sequential epitope and conformational epitope.   4

(c) Comment on IgE mediated Hypersensitivity with proper diagram.   4

(d) Write notes on ADCC.   4

3. Answer any *one* question of the following :   8 × 1

(a) Write the principle of Southern Blotting Hybridization (SBH). Discuss briefly the steps and application of SBH.   1 + 5 + 2

(b) (i) What do you mean by Antigen processing and presentation ?

(ii) Make a comparative account of class I MHC peptide and class II MHC peptide interaction with proper illustration. 2 + 6

GROUP – B

(Cytology & Genetics)

1. Answer any *two* of the following : 2 × 2

(a) Show whether the population of L^ML^M 406, L^ML^N 744, L^NL^N 332 is in Hardy-Weinberg equilibrium.

(b) Trans genotype $rU + / + rV$ produces burst size of 258 and $rU + / + rY$ produces 0 burst size. Predict whether rU, rV, rY present in the same cistron or not.

(c) State key characteristics of Retroviruses. State uses of reverse transcriptase.

(d) Name two tumor suppressor gene preventing breast cancer and ovarian cancer.

2. Answer any *two* of the following : 4 × 2

(a) Abortive transductions are relatively stable merozygotes which can be used for complementation tests. Six mutants are tested in all pairwise combinations, yielding the result shown in the table (+ = complementation, 0 = non-complementation). Construct the complementation map with consistent data.

1	2	3	4	5	6	
0	+	0	+	+	+	1
	0	0	+	+	+	2
		0	+	+	+	3
			0	0	+	4
				0	0	5
					0	6

(b) A DNA fragment obtained from a bacterial population whose genotype is pur^+ pro^- his^-. Cuts were made at random. A mixture of these fragments were added to a culture of

a recipient bacterium having genotype pur^- pro^+ his^+ and pur^+ recombinant were selected. From the data given below predict the gene order.

Genotype	Number of Colonies
pro^+ his^+	103
pro^- his^+	24
pro^+ his^-	158
pro^- his^-	1

(c) Make a complete linkage map from the table showing accompanying markers in specific $P1$ transductions

Experiment	Selected markers	Unselected markers
1	leu^+	50 % are azi^r ; 2 % are thr^+
2	thr^+	3 % are leu^+; 0 % are azi^r
3	leu^+ and thr^+	0 % are azi^r

(d) Suppose that a cell is heterozygous for a mutation that caused p^{53} to bind constitutively to DNA of target gene. How would this mutation affect the cell cycle ? Would such a cell be expected to be more or less sensitive to the effects of ionizing radiation ?

3. Answer any *one* of the following :   8 × 1

(a) The gene for coat color in rabbit can exist in four alleles formed C (full coat color), C^{ch}(Chinchilla),C^{h}(Himalayan) and c(albino). $(C > c^{ch} > c^{h} > c)$. In a population of rabbits in Hardy-Weinberg equilibrium, the allele frequencies are

$$C = 0.34$$
$$c^{ch} = 0.17$$
$$c^{h} = 0.44$$
$$c = 0.05$$

(i) What is the frequency of albino rabbits ?

(*Continued*)

(*ii*) Among 1000 rabbits, how many would you expect to have a Himalayan Coat color ?

(*iii*) Among 1000 rabbits, how many would be heterozygous with a chinchilla coat color ?   2 + 3 + 3

(*b*) Prof Watson has characterized five *E. Coli* F⁻ strains,each harboring a different deletion in the lac *z* gene. The line in the diagram show the relative location and sizes of five deletions A, B, C, D & E.

Deletion　　　　lac *z* gene

A ────────────────

B ────────────────

C 　────────────────

D 　　────────────────

E ──────────────
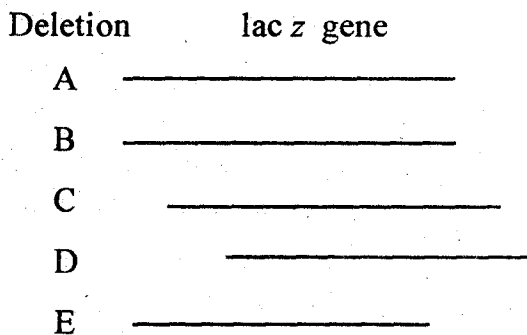
Dr. Watson also induced several lac Z^- point mutations by nitrous acid. When she crossed eight mutant strains with each of

the five deletion strains, the following results were obtained, where '+' indicates the formation of lac z^+ recombinants and '0' indicates that no lac z^+ recombinants are produced.

	Point mutants							
Deletion	1	2	3	4	5	6	7	8
A	+	0	0	0	0	+	0	0
B	+	0	0	0	+	+	0	0
C	+	0	+	0	0	+	0	+
D	+	0	+	0	0	+	+	+
E	+	+	+	0	+	+	0	0

(i) What is the linear order of the point mutations that can be ordered on the basis of the above data ?

(ii) Which of the eight point mutations can not be ordered relative to the other mutations studied on the basis of these data ?   6 + 2