Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS / M.SC (GE) / SEM-1 / MSGEN-104 / 2010-11

2010-11

GENETICS OF ORGANELLES

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.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) An intimate biological partnership that literary means living together and helping each other is called as

a) partnership b) endosymbiosis

c) togetherness d) none of these.

ii) Petite colonies in yeast are actually a defect in

a) glucose metabolism b) starch metabolism

c) lipid metabolism d) none of these.

iii) Mitochondrial genome in mammals is about

a) 42.5 kb b) 18.5 kb

c) 23.0 kb d) 16.5 kb.

iv) *mt*DNA lacks

a) non-histone proteins b) histone proteins

c) ATPase d) none of these.

v) The number of mating types present in Chlamydomonas is

a) two b) four

c) five d) six.

vi) In yeast very small colonies can arise through respiration-deficient

a) mitochondrial mutants

b) plastid mutants

c) nuclear mutants

d) none of these.

vii) The killer phenotype in Paramoecium must contain a symbiotic

a) Algae b) Bacteria

c) Fungi d) Virus.

viii) Late onset degenerative diseases are labelled as disorders of

a) Cytoplasm b) Nucleus

c) Mitochondria d) Lysosome.

ix) In *mt*DNA of human the methionine codon is

a) AUA b) AGA

c) AAG d) GAU.

x) In *mt*DNA of vertebrates the stop codon is

a) AUA b) AGA

c) AAG d) GAU.

xi) Size of the *mt*DNA in *Xenopus leavis* is

a) 14284 b) 17533

c) 27694 d) none of these.

xii) In a rat liver cell out of total cellular DNA, *mt*DNA constitutes

a) 10% b) 5%

c) 3% d) 1%.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What types of evidence indicate that mitochondria and chloroplasts are derived from bacteria ? State Endosymbiotic theory. 4 + 1

3. A mutant strain of yeast that produced tiny colonies when grown on glucose rich medium was crossed to a wild type strain. All the progenies were wild type. What kind of mutation was responsible for the tiny colonies ? Explain the result. 3½ + 1½

4. Define guide RNAs mentioning their functions.

5. Write a short note on ancestral and derived mitochondrial genome.

6. Discuss the characteristic features of yeast mitochondrial DNA.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Briefly describe the organization of the genes on the chloroplast genome. What is meant by the term 'promiscuous DNA' ? Write about the biogenesis of chloroplast. 8 + 3 + 4

8. An *mt* (+) strain of *Chlamydomonas* that was resistant to the antibiotic spectinomycin was crossed with a sensitive *mt* (–) strain. Half the progeny were *mt* (+) and half were *mt* (–), but all were resistant to spectinomycin. When the *mt* (–) spectinomycin-resistant cells were crossed to *mt* (+) spectinomycin-sensitive cells, all the progeny were spectinomycin-sensitive. Explain the inheritance of spectinomycin resistance / sensitivity with diagram.

9. Write short notes on any three : 3 × 5
   a) Heteroplasmy and homoplasmy
   b) Organization of human mitochondrial genome
   c) Poky mutation in neurospora exhibiting maternal inheritance
   d) Cytoplasmically inherited male sterility.
   e) Mitochondrial proteins.

10. 'Mitochondrial DNA undergoes rapid evolutionary changes than nuclear DNA.' Explain. Discuss two diseases that result from mitochondrial gene mutation. Discuss the distinctive features of mitochondrial genome replication. 5 + 5 + 5

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