UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

MARCH 2025 SEMESTER

COURSE CODE	:	HDD10903
COURSE TITLE	:	HUMAN GENETICS
PROGRAMME NAME	:	DIPLOMA OF MEDICAL LABORATORY TECHNOLOGY
DATE	:	23 JUNE 2025
TIME	:	2:00PM - 5:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Section A consist 25 MCQ or EMQ questions. Answer ALL questions.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
9. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 12 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 25 marks)

Answer ALL questions.

Please use the objective answer sheet provided.

1. Which of the following are types of point mutations?

   A. Substitution, insertion and deletion

   B. Insertion, deletion and frameshift

   C. Substitution, insertion and frameshift

   D. Substitution, deletion and frameshift

2. In RNA, adenine always pairs with _____.

   A. uracil

   B. guanine

   C. thymine

   D. cytosine

3. When dominant and recessive alleles express themselves together as an intermediate form of the two, the condition is called _____.

   A. incomplete dominant

   B. pseudo dominance

   C. co-dominant

   D. partial dominance

4. The original strand of DNA is ACGTCTCGA, however the mutated strand has the sequence of ACGTCTACGA. Identify the type of mutation described.

   A. nucleotide base deletion

   B. nonsense mutation

   C. nucleotide base insertion

   D. silent mutation

5. If a change occurs in a base sequence of a DNA, it might cause a different _____ to be substituted in a protein.

   A. amino acid

   B. ribosome

   C. nucleic acid

   D. enzyme

6. A single base deletion that causes regular codon reading frame to change into another codon window that codes for different amino acid subsequent to the deletion site is said to be _____ mutation.

   A. missense

   B. INDELs

   C. nonsense

   D. frame-shift

7. Select the functions which have been identified for the proteins expressed by cellular proto-oncogenes.

I. growth factor
II. transcription factor
III. growth factor receptor
IV. enzyme involved in DNA mismatch repair

A. I, III, IV

B. I, II, III

C. II, III, IV

D. I, II, III, IV

8. Western blotting is the technique for the detection of specific _____ in a sample.

A. glycolipid

B. protein

C. DNA

D. RNA

9. An organism with two non-identical alleles is described as _____.

A. heterozygous

B. dominant

C. recessive

D. homozygous

10. Transition which is a type of gene mutation is caused when _____.

A. AT is replaced by CG

B. AT is replaced by GC

C. CG is replaced by GC

D. GC is replaced by TA

11. The allele which is able to completely express its effect in the presence of another allele is called _____.

    A. dominant

    B. recessive

    C. incomplete dominant

    D. co-dominant

12. By convention, the sequence of bases in a nucleic acid is usually expressed in the _____ direction.

    A. 5' to 3'

    B. 1' to 3'

    C. 3' to 1'

    D. 3' to 5'

13. The original strand of DNA looks like this ACGTCTCGA, the mutated strand looks like this ACGTATCGA. Identify the type of mutation described previously.

    A. missense mutation

    B. nucleotide base substitution

    C. nucleotide base deletion

    D. nucleotide base insertion

14. Select which of the following descriptions of chromosomes are **CORRECTLY** matched.

I. Telocentric — there is only one chromosome arm.
II. Acrocentric — chromosome arms are identical in size.
III. Metacentric — chromosome arms are almost equal in size.
IV. Submetacentric — chromosome arms are slightly different in size.

A. II, III, IV

B. I, III, IV

C. I, II, III

D. I, II, III, IV

15. Cancer is often the result of the inactivation of _____ genes and the activation of _____ to _____.

A. proto-oncogenes, oncogenes, tumor-suppressor genes

B. tumor-suppressor genes, proto-oncogenes, oncogenes

C. proto-suppressor genes, suppressors, oncogenes

D. oncogenes, proto-oncogenes, tumor-suppressor genes

16. Which of the following is a characteristic of a malignant rather than a benign tumour?

A. Undergoes metastasis

B. Grows without needing a growth signal

C. Develops a blood supply

D. Cells divide an unlimited number of times

17. In DNA, guanine always pairs with _____.

A. uracil

B. cytosine

C. thymine

D. adenine

18. With few exceptions, all nuclei of eukaryotes contain _____.

A. all the information needed for growing the whole organism

B. genes to specify the portion of the organism in which they are found

C. only euchromatin

D. all of the chromosomes except sex chromosomes which are restricted to sex organs

19. The MNS blood group system is an example of _____.

A. pleiotrophy

B. incomplete dominance

C. codominant

D. incomplete recessive

20. A cross between heterozygous tall (Tt) and homozygous tall (tt) results in a progeny of 12 offsprings. Which of the following numbers would represent the number of phenotypically tall progenies of the F_1 generation?

A. 6

B. 0

C. 3

D. 12

21. The hybrid progeny in the second generation is called as _____.

A. F1

B. F0

C. F2

D. parental

22. Which of the following option shows the characteristic of a phenotypic ratio 3:1?

A. A trihybrid cross

B. A monohybrid cross

C. A dihybrid cross

D. Linked genes

23. Heterochromatin is a(n) _____ form of chromatin.

A. elongated

B. concentrated

C. lightly packed

D. tightly packed

24. A change in a DNA sequence due to damage or being incorrectly copied is called _____.

A. segregation

B. evolution

C. meiosis

D. mutation

25. The centromere is a region in which _____.

A. metaphase chromosomes become aligned at the metaphase plate.

B. the nucleus is located prior to mitosis.

C. chromosomes are grouped during telophase.

D. chromatids remain attached to one another until anaphase.

SECTION B (Total: 75 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

Explain how different classes of mutagens cause DNA damage, the relationship between mutations and cancer, and the body's defense mechanisms against cancer, including how these mechanisms may sometimes fail.

(25 marks)

Question 2

(a) Define proto-oncogene and tumour suppressor gene.

(4 marks)

(b) List and describe **FOUR (4)** mechanisms on how oncogene contribute to the development of cancer.

(8 marks)

(c) Describe familial (germline) cancer.

(3 marks)

(d) Define following terms:

i) gene therapy.
ii) transgene.
iii) transgenic.

(6 marks)

(e) State and describe TWO (2) goals of gene therapy.

(4 marks)

Question 3

(a) Draw and label a simplified diagram for a nucleic acid.

(5 marks)

(b) Discuss the flow of information according to the central dogma of molecular biology.

(5 marks)

(c) Describe how each of the following types of mutations affects the functional protein expressed from a gene.

i. Nonsense
ii. Missense
iii. Silent
iv. Frame-shift
v. Inversion

(10 marks)

(d) State **THREE (3)** mutagens.

(3 marks)

(e) State the difference between single nucleotide variation (SNV) and single nucleotide polymorphism (SNP).

(2 marks)

Question 4

(a) Explain polymerase chain reaction (PCR) process.

(7 marks)

(b) State TWO (2) differences between agarose gel electrophoresis (AGE) and polyacrylamide gel electrophoresis (PAGE).

(6 marks)

(c) Draw and fill a table that compares between Southern, Northern, Western, and South-Western blotting. The table should (but not be limited to) include each of the blotting technology's purpose, type of sample, method of sample separation, and sample detection mechanism.

(12 marks)

END OF EXAMINATION PAPER