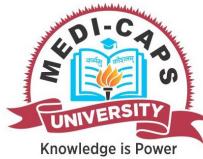


Enrollment No.....



Duration: 3 Hrs.

Faculty of Science

End Sem Examination Dec 2024

FS3EL05 Forensic Genetics

Programme: B.Sc.

Branch/Specialisation: Forensic Science

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

|  | Marks | BL | PO | CO | PSO |
|--|-------|----|----|----|-----|
| Q.1 i. Which of the following components make up a DNA nucleotide?   | 1     | 01 | 03 | 01 |     |
| (a) Sugar, phosphate, nitrogenous base<br>(b) Sugar, amino acid, phosphate<br>(c) Fatty acid, sugar, nitrogenous base<br>(d) Amino acid, nitrogenous base, glucose |       |    |    |    |     |
| ii. Which of the following is NOT a recognized form of DNA?  | 1     | 02 | 01 | 01 |     |
| (a) B-DNA<br>(b) A-DNA<br>(c) Z-DNA<br>(d) F-DNA   |       |    |    |    |     |
| iii. How is mitochondrial DNA inherited?   | 1     | 02 | 03 | 02 |     |
| (a) From both parents<br>(b) Only from the father<br>(c) Only from the mother<br>(d) Randomly from either parent   |       |    |    |    |     |
| iv. In a slot blot assay, what type of membrane is typically used for immobilization of samples?   | 1     | 01 | 02 | 02 |     |
| (a) Polycarbonate membrane<br>(b) Nitrocellulose membrane<br>(c) Agarose gel<br>(d) Cellulose acetate  |       |    |    |    |     |

|       | [2]  |                          | [3]   |
|-------|--|--------------------------|---|
| v.    | Why is proteinase K often used in DNA extraction?<br>(a) To precipitate DNA<br>(b) To digest proteins that may contaminate the DNA<br>(c) To break down lipids<br>(d) To enhance lysis of cells                    | 1 02 02 03               | (a) Types of DNA<br>(b) Mendel's law of segregation   |
| vi.   | Which sample type is often analyzed for DNA?<br>(a) Semen (b) Saliva<br>(c) Skin cells (d) All of these  | 1 02 03 03               | Q.3 i. What is gel electrophoresis? Write its forensic importance. 3 02 02 02<br>ii. What is mitochondrial DNA? Explain how mitochondrial DNA is different from nuclear DNA? 7 02 03 02<br>OR iii. What is slot blot technique? Explain its principle and working procedure. 7 03 04 02 |
| vii.  | In the RFLP technique, what is the role of restriction enzymes?<br>(a) To amplify DNA<br>(b) To cut DNA at specific sequences<br>(c) To separate DNA fragments by size<br>(d) To label DNA fragments               | 1 01 02 04               | Q.4 i. Write the basic principle of DNA extraction from organic method. 3 02 04 03<br>ii. Explain two inorganic methods for DNA extraction in detail. 7 02 04 03<br>OR iii. Write the collection and preservation methods of different biological samples for DNA testing. 7 01 02 03   |
| viii. | What does VNTR stand for?<br>(a) Variable Number of Tandem Repeats<br>(b) Variable Nucleotide Tandem Repeats<br>(c) Variable Nucleotide Tract Repeats<br>(d) Variable Number of Transcribed Repeats                | 1 01 01 04               | Q.5 i. Write the forensic importance of DNA in wildlife crime investigation. 2 02 02 04<br>ii. Write a note on-<br>(a) Short tandem repeat<br>(b) Southern blotting<br>OR iii. Explain the procedure of RFLP technique and write its limitations and advantages. 8 02 04 04             |
| ix.   | What is the primary purpose of PCR?<br>(a) To sequence DNA<br>(b) To amplify specific DNA sequences<br>(c) To digest DNA<br>(d) To visualize DNA   | 1 02 04 05               |   |
| x.    | What does NCBI stand for?<br>(a) National Center for Bioinformatics<br>(b) National Center for Biology Information<br>(c) National Center for Biotechnology Information<br>(d) National Center for Biological Data | 1 01 03 05               | Q.6 Attempt any two:<br>i. What is PCR technique. Explain the key steps of PCR technique. 5 02 03 05<br>ii. Define touch DNA. Explain sequence polymorphism in detail. 5 02 01 05<br>iii. Give brief introduction of NCBI database and Y-STR. 5 02 02 02                                |
| Q.2   | i. What is DNA? Explain Watson and Crick's double helical model of DNA.<br>ii. Write a note on-<br>(a) Genetic code (b) Chargaff's rule  | 4 02 01 01<br>6 02 04 01 | *****   |
| OR    | iii. Write a note on -   | 6 02 02 01               |   |

**Marking Scheme**  
**FS3EL05 (T) Forensic Genetics (T)**

|     |  |           |
|-----|--|-----------|
| Q.1 | i) (a) Sugar, phosphate, nitrogenous base                              | 1         |
|     | ii) (d) F-DNA  | 1         |
|     | iii) (c) Only from the mother  | 1         |
|     | iv) (b) Nitrocellulose membrane  | 1         |
|     | v) (b) To digest proteins that may contaminate the DNA                 | 1         |
|     | vi) (d) All of the above   | 1         |
|     | vii) (b) To cut DNA at specific sequences                              | 1         |
|     | viii) (a) Variable Number of Tandem Repeats                            | 1         |
|     | ix) (b) To amplify specific DNA sequences                              | 1         |
|     | x) (c) National Center for Biotechnology Information                   | 1         |
| Q.2 | i. What is DNA? Explain Watson and Cricks double helical model of DNA. | 4         |
|     | Definition   | -1 mark   |
|     | Structure and composition according to model                           | - 2 marks |
|     | Diagram  | - 1 mark  |
|     | ii. Write a note on  | 6         |
|     | (a) Genetic code   |           |
|     | Definition   | - 1 mark  |
|     | Properties   | - 2 marks |
|     | (b) Chargaff's rule  |           |
|     | Statement  | - 2 marks |
| OR  | Example  | - 1 mark  |
|     | iii. Write a note on   | 6         |
|     | (a) Types of DNA   |           |
|     | A DNA  | - 1 mark  |
|     | B DNA  | - 1 mark  |
|     | Z DNA  | - 1 mark  |
|     | (b) Mendels Law of Segregation   |           |
|     | Statement  | - 1 mark  |
|     | Experimental example   | - 2 marks |
|     | Q.3 i. What is gel electrophoresis? Write its forensic importance.     | 3         |
| Q.3 | Definition   | - 1 mark  |
|     | Principle  | - 1 mark  |
|     | Forensic importance  | - 1 mark  |

- ii. What is Mitochondrial DNA. Explain how Mitochondrial DNA is different from nuclear DNA? 7
- Defination of mDNA - 1 mark  
 Properties - 2 marks  
 Diagram - 1 mark  
 Difference between mDNA and Ndna. -3 marks
- OR iii. What is slot blot technique? Explain its principle and working procedure. 7
- Definition and principle - 1 mark  
 Diagram - 1.5 marks  
 Working procedure - 4 marks  
 Application - 0.5 mark
- Q.4 i. Write the basic principle of DNA extraction from organic method. 3
- DNA extraction - 1 mark  
 Principle - 2 marks
- ii. Explain two inorganic methods for DNA extraction in detail. 7
- Principle and procedure of 1<sup>st</sup> inorganic method - 3.5 marks  
 Principle and procedure of 2<sup>nd</sup> inorganic method - 3.5 mark
- OR iii. Write the collection and preservation methods of different biological samples for DNA testing. 7
- Collection methods of samples (blood, semen, saliva etc.) - 3.5 marks  
 Preservation - 3.5 marks
- Q.5 i. Write the forensic importance of DNA in wildlife crime investigation. 2
- ii. Write a note on 8
- (a) Short Tendem Repeat  
 Explanation - 1.5 marks  
 Example - 1.5 marks  
 Importance - 1 marks
- (b)Southern Blotting  
 Define - 1 marks  
 Procedure - 2 marks  
 Diagram - 1 mark

|     |      |  |             |
|-----|------|--|-------------|
|     |      | [2]  |             |
| OR  | iii. | Explain the procedure of RFLP technique and also write its limitations and advantages. | <b>8</b>    |
|     |      | Define RFLP  | - 1 mark    |
|     |      | Procedure  | - 3 marks   |
|     |      | Diagram  | - 2 marks   |
|     |      | Limitations  | - 1 mark    |
|     |      | Advantages   | - 1 mark    |
|     |      |  | [3]         |
| Q.6 | i.   | What is PCR technique. Explain the key steps of PCR technique.                         | <b>5</b>    |
|     |      | Introduction   | - 1 mark    |
|     |      | Working principle and process  | - 2.5 marks |
|     |      | Diagram  | - 1.5 marks |
|     | ii.  | Define Touch DNA. Explain sequence polymorphism in detail.                             | <b>5</b>    |
|     |      | Definition of touch DNA  | - 1 mark    |
|     |      | Sources  | - 1 mark    |
|     |      | Sequence polymorphism  | - 1 mark    |
|     |      | SNP  | - 2 mark    |
|     | iii. | Give brief introduction of NCBI database and Y-STR.                                    | <b>5</b>    |
|     |      | Brief details of NCBI  | -2.5 marks  |
|     |      | Brief details of Y-STR   | - 2.5 marks |

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