Faculty of Medicine, University of Ruhuna
Medical Laboratory Science Degree Programme

Year end examination 2nd Year – November 2014
4th Batch - Theory -

Genetics and Molecular biology – Theory -SEQ
05th December 2014 Time: 2.00 p.m. to 4.00 p.m. (two hour)

Instructions:
Use the space provided for answering **Index Number:**
Answer all the questions. Each question carries 25 marks. (Total 100 marks)

10

Question 01.

DNA replication is the process which copies the DNA in a cell. After replication is complete the cell divides forming to two identical daughter cells.

1.1. What are the functions of the following enzymes in regard to DNA replication (3)

1.1.1. DNA polymerase.

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1.1.2. Helicase.

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1.1.3. Topoisomerase.

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1.2. Describe the following

1.2.1. Leading strand and the lagging strand. (5)

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1.2.2. Single stranded binding proteins. (5)

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1.3. Proteins—large complex molecules—are major building blocks of all living organisms.

Describe the steps of protein synthesis beginning with the attachment of a messenger RNA molecule to the small subunit of a ribosome and ending with the release of the polypeptide from the ribosome. Include in your answer a discussion of how the different types of RNA function in this process. (12)

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estion 02.

2.1. Discuss the process of cell division in animals. Include a description of mitosis and cytokinesis, and of the other phases of the cell cycle. DO NOT include meiosis. (9)

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2.2.1 A lab technician needs to perform a Southern blot analysis to analyze a particular genetic disorder. He has requested the following material. Mention the usefulness of the following material for the Southern blot analysis.

a) Nitrocellulose membrane. (4)

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b) Whatman papers. (4)

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c) Probe. (4)

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2.1 A lab technician needs to perform a Southern blot analysis to analyze a particular genetic disorder. He has requested the following material. Mention the usefulness of the following material for the Southern blot analysis.

a) Nitrocellulose membrane. (4)

2.2. He needs to set up a Southern Blot transfer. Write the following components in the correc order for the transfer from the cathode to the anode. (4)

Gel , Nitrocellulose Membrane ,2 sets of Whatman Filter paper, Paper towels

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Question 03.

3.1. What are the 3 main steps and the corresponding temperature ranges in a polymerase chain reaction (PCR)? (3)

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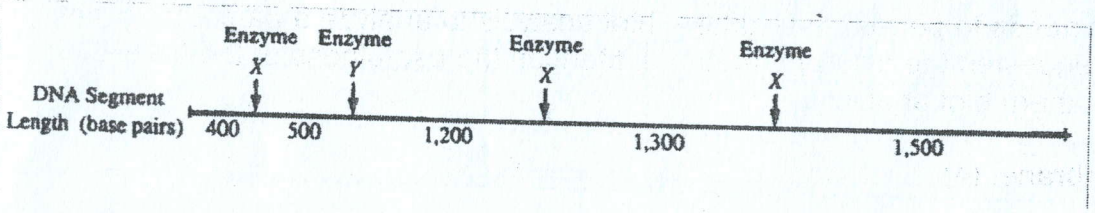
3.2. The diagram below shows a segment of DNA with a total length of 4,900 base pairs. The arrows indicate reaction sites for two restriction endonuclease enzymes (enzyme X and enzyme Y).



3.2.1. Explain the principle of gel electrophoresis which allow the separation of DNA fragments. (5)

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2. Describe the results you would expect from the electrophoretic separation of fragments the following treatments of the DNA segment above. Assume that the digestion occur under appropriate conditions and went to completion. (4)

a) DNA digested with only enzyme X

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b) DNA digested with only enzyme Y

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c) DNA digested with enzyme X and enzyme Y combined

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d) Undigested DNA

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3.3. A linear fragment of DNA is digested with the restriction enzyme EcoRI. Two fragments are producted, 450 bp and 500 bp. The same fragment is digested with HaeIII. Two fragments are produced, 200 bp and 750 bp. When the fragment is digested with both enzymes, the fragments are 200 bp, 250 bp, and 500 bp. Can you create a restriction site map for the fragment from these data? (13)

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uestion 04

4.1. Describe the function of telomeres in eukaryotes (5)

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4.2 Red-green colour blindness is X-linked in humans. If a male is red-green colour blind, and both parents have normal colour vision which of the male's grandparents is most likely to be red-green colour blind? (5)

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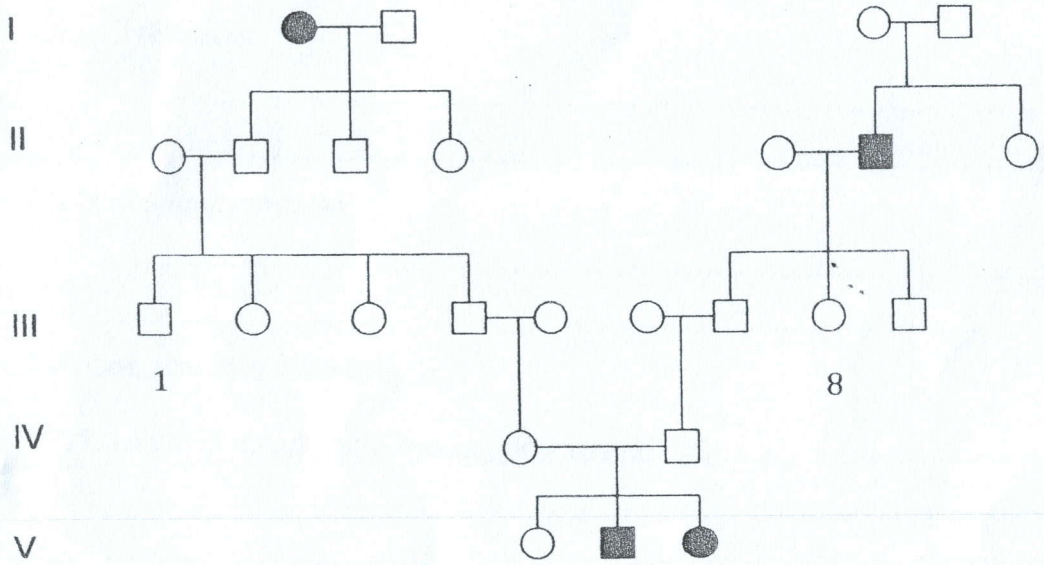
4.3. The following pedigree was obtained for a rare kidney disease.



4.3.1. What is the likely mode of inheritance of this disease? Explain. (7)

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4.3.2. If individuals III-1 and III-8 marry, what is the probability that their first child will have the kidney disease? (8)

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