Faculty of Agriculture
Genetics
First Exam

Instructor: **Name of student:** **key**

Q1. (7 POINTS) Circle the most correct answer: **(ILOs 1, 2, 3)**

1. Crossing over occurs in _____ of meiosis
   a) <u>Prophase I</u>
   b) Prophase II
   c) Telophase I
   d) Telophase II
2. The nucleotide which is not found in DNA is:
   a) A
   b) <u>U</u>
   c) T
   d) G
3. In translation, the newly arrived tRNA binds to the:
   a) <u>A site</u>
   b) P site
   c) E site
   d) None of the above
4. An important enzyme involved in transcription is:
   a) <u>RNA polymerase</u>
   b) DNA polymerase
   c) Peptidyl transferase
   d) Primase
5. In the monohybrid cross of Mendel, the **phenotypic ratio** in the F2 is:
   a) <u>3:1</u>
   b) 1:2:1
   c) 1:1:1:1
   d) 9:3:3:1
6. In the dihybrid cross, the ratio of gametes formed from F1 genotypes is:
   a) 3:1
   b) 1:2:1
   c) **<u>1:1:1:1</u>**
   d) 9:3:3:1
7. The **2n** number of chromosomes in domestic goats is:
   a) 46
   b) 54
   c) <u>60</u>
   d) 78

Q2. (ILOs 1, 2, 3)

a) **(2 POINTS)** Give two differences between replication in prokaryotes and eukaryotes

1) Replication in eukaryotes is more complex than in prokaryotes

2) In eukaryotes there are multiple origins of replication while in prokaryotes there is one origin.

3) Ends of the linear chromosomes in eukaryotes are replicated by telomerase while this does not happen in prokaryotes where the DNA is circular.

b) **(5 POINTS)** Complete the following:

1. The ability of DNA polymerase to remove mismatched pairs during DNA replication is called ___ **proofreading** _____ function.
2. In translation, the start codon is ___**AUG**_____ and a stop codon is __**UAA, UGA, or UAG**_____
3. The termination of translation is assisted by special proteins called ____**Termination factors or release factors**_____
4. ____**Splicing**_____ is the removal of introns and rejoining of exons.

Q3. **(ILO 3)**

a) **(2 POINTS)** give the classification of chromosomes based on position of the centromere

- **Metacentric:** centromere location is in the middle of the chromosome. **Submetacentric:** centromere location is between the middle and the end of the chromosome.
- **Acrocentric:** centromere location is close to the end of the chromosome.
- **Telocentric:** centromere location is at the end of the chromosome.

b) **(1.5 POINTS)** In the cell cycle, the interphase is divided into three phases, what are these?

1. _____G1 phase_____
2. _____S phase_____
3. _____G2 phase_____

c) **(2 POINTS)** Give two points which indicate the importance of **caping** of the pre-mRNA

- **Protection of mRNA from nuclease activity**
- **Recognition of the ribosome (plays a role in initiation of translation)**
- **Influences the removal of introns.**
- **Cap-binding proteins are needed for the proper exit of certain RNAs from the nucleus**

Q4. (5 POINTS) **(ILO 4)**

a) **(2 POINTS)** State Mendel's law of **independent assortment**:

During the formation of gametes, the paired unit factors (alleles) separate or segregate randomly so that each gamete receives one factor (allele) or the other with equal probability (chance).

b) **(3.5 POINTS)** Explain the **test cross** giving an example

- **A test designed to reveal the genotype of an individual which shows the dominant phenotype. In this cross, the individual with unknown genotype but showing the dominant phenotype is crossed to a homozygous recessive individual (an individual showing the recessive phenotype).**

- **Example:**

Tall plant (*DD* or *Dd*) x Dwarf plant (*dd)*

- If the geotype of the tall plant is *DD* ➔ we expect all offspring plants to be tall (have *Dd* genotype)
- If the genotype is *Dd* ➔ we expect half the offspring to be tall (*Dd*) and the other half to be dwarf (*dd*).