**Midsem: Fundamentals of Biology II by Dr. Gaurav Ahuja Date: 25/09/2025**

**Max Marks 50**

**Multiple Choice Question (Attempt any 5, 5 marks each, -1 negative)**

1. If a mutation in a GPCR prevents GDP from being released, what will be the effect on signaling?
   a) G protein will remain active continuously
   b) G protein will remain inactive
   c) cAMP levels will increase
   d) Arrestin will immediately block the receptor

2. A researcher observes that two different hormones, though structurally unrelated, trigger glycogen breakdown in liver cells. Which concept does this illustrate?
   a) Divergent signaling
   b) Convergent signaling
   c) Feedback inhibition
   d) Hormonal redundancy

3. If a kinase is overactive and cannot be turned off by phosphatases, what cellular effect is most likely?
   a) Uncontrolled protein activation leading to cancer-like growth
   b) Decreased metabolic activity
   c) Permanent DNA damage repair
   d) Decreased sensitivity to hormones

4. Which scenario best explains why two identical twins raised in the same environment may show different natural hair colors?
   a) DNA point mutations in one twin
   b) Differences in epigenetic modifications
   c) Crossing over during meiosis
   d) Errors in DNA replication during embryogenesis

5. A mutation in a mismatch repair enzyme leads to elevated mutation rates across the genome. Which property of cancer does this support?
   a) Loss of contact inhibition
   b) Genetic instability
   c) Evading apoptosis
   d) Angiogenesis

6. During DNA replication, strand slippage occurs at repetitive sequences. What is the likely outcome?
   a) Point mutation

b) Frameshift mutation due to insertion or deletion
c) Translocation
d) Pyrimidine dimer formation

7. Which repair mechanism would be most useful if a guanine is oxidized to form 8-oxo-guanine?
   a) Base-excision repair
   b) Nucleotide-excision repair
   c) Homologous recombination
   d) Mismatch repair

**Short Answer Questions (Attempt any 3, 5 marks each)**

1. Compare and contrast autocrine, paracrine, and endocrine signaling with one biological example each.

2. Explain the process of GPCR desensitization. Why is this mechanism important for cells?

3. How can two genetically identical organisms (such as identical twins) show different traits? Explain with reference to epigenetics.

4. What is the difference between a mutation and a polymorphism? Give one example of each.

5. Describe the Holliday model of homologous recombination and its significance in DNA repair.

**Long answer question (10 marks)**

1. Explain the concepts of DNA mutations and polymorphisms, including the different types of each and how they are distinguished from one another. (3 Marks)

   b)Describe the various types of mutations, including point mutations and expanding nucleotide repeats. (2 Marks)

   c) Discuss at least three factors that can influence mutation rates. (2 Marks)

   d)Detail at least three DNA repair mechanisms, explaining the specific types of DNA damage each system is designed to correct. (3 Marks)