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| **Name:**<br>**Enrolment No:** | |

**UPES**

**End Semester Examination, December 2024**

**Course: Diagnostic Biochemistry** **Semester : VII**

**Program: INT-BMSC-N-D**

**Duration : 3 Hours**

**Course Code: HSBC8001O_3** **Max. Marks: 100**

| S. No. | Section A<br>Short answer questions/ MCQ/T&F<br>(20Qx1.5M= 30 Marks) | Marks | COs |
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| 1 | **Select the preservative, which is commonly used for urine specimens to prevent bacterial growth during transport.**<br><br>A) Sodium fluoride<br>B) Formaldehyde<br>C) Boric acid<br>D) Sodium citrate | 1.5 | CO 1 |
| 2 | **This is the unit of measurement for osmolarity:**<br><br>A) Moles per liter (mol/L)<br>B) Moles per kilogram (mol/kg)<br>C) Osmoles per liter (osmol/L)<br>D) Osmoles per kilogram (osmol/kg) | 1.5 | CO 1 |
| 3 | **_____ is a key characteristic of an ideal biosensor?**<br><br>A) High selectivity for a specific analyte<br>B) High operating temperature<br>C) High power consumption<br>D) The inability to regenerate after use | 1.5 | CO 1 |
| 4 | **It is the primary diagnostic method used to assess liver function:**<br><br>A) Serum creatinine levels<br>B) Alanine aminotransferase (ALT) and aspartate | 1.5 | CO 1 |

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| | aminotransferase (AST)<br>C) C-reactive protein (CRP)<br>D) Serum glucose levels | | |
| **5** | **_____ is NOT typically examined in a routine urine analysis.**<br><br>A) Protein levels<br>B) Glucose levels<br>C) Hemoglobin levels<br>D) Vitamin B12 levels | **1.5** | **CO 1** |
| **6** | **The measurement of creatine kinase isoenzymes (CK-MB) is commonly used for……**<br><br>A) Liver function tests<br>B) Assessing the severity of kidney disease<br>C) Diagnosing myocardial infarction<br>D) Detecting gallbladder disease | **1.5** | **CO 1** |
| **7** | **For selecting a method for biochemical analysis, the "precision" of the method refers to:**<br><br>A) The ability of the method to produce consistent results under identical conditions<br>B) The ability to differentiate between substances with similar properties<br>C) The speed at which the test results are obtained<br>D) The ability to detect very low concentrations of the analyte | **1.5** | **CO 1** |
| **8** | **Fluorometry measures the fluorescence emitted by a sample after it absorbs light. Which of the following properties of a fluorophore is primarily measured?**<br><br>A) Its emission wavelength<br>B) Its temperature stability<br>C) Its atomic structure<br>D) Its pH sensitivity | **1.5** | **CO 1** |
| **9** | **In which type of immobilization technique, enzymes physically held on the surface of a support material without chemical bonding.**<br><br>A) Covalent bonding<br>B) Entrapment | **1.5** | **CO 1** |

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| | C) Adsorption<br>D) Cross-linking | | |
| **10** | **_____ primarily affects the efficiency of enzyme immobilization on a solid support.**<br><br>A) The solubility of the enzyme<br>B) The molecular weight of the enzyme<br>C) The surface area of the support material<br>D) The color of the support material | **1.5** | **CO 1** |
| **11** | **In Lesch-Nyhan syndrome, the buildup of uric acid occurs due to:**<br><br>A) Increased synthesis of purines<br>B) Decreased degradation of purines<br>C) Reduced excretion of uric acid by the kidneys<br>D) Decreased breakdown of uric acid in the liver | **1.5** | **CO 1** |
| **12** | **In gout, the deposition of monosodium urate crystals primarily occurs in…….**<br><br>A) Kidneys<br>B) Joints<br>C) Skin<br>D) Liver | **1.5** | **CO 1** |
| **13** | **Which statements is TRUE about osmolarity.**<br><br>A) It measures the number of moles of solute per kilogram of solvent<br>B) Osmolarity is useful in calculating the effect of solutes on colligative properties such as freezing point depression<br>C) Osmolarity depends only on the volume of the solution<br>D) Osmolarity is used exclusively for ionic compounds | **1.5** | **CO 1** |
| **14** | **The characteristic feature of Type 1 Diabetes Mellitus is**<br><br>A) Insulin resistance<br>B) Insulin deficiency due to autoimmune destruction of pancreatic beta cells<br>C) Hyperglycemia due to excessive carbohydrate intake<br>D) Decreased glucagon production | **1.5** | **CO 1** |
| **15** | **_____ is the most common causative organism of** | **1.5** | **CO 1** |

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| | **urinary tract infections (UTIs).**<br><br>*A) Streptococcus pneumoniae*<br>B) *Escherichia coli*<br>C) *Staphylococcus aureus*<br>D) *Pseudomonas aeruginosa* | | |
| **16** | **A characteristic finding in a urinalysis of a patient with a UTI is……..**<br><br>A) Elevated glucose levels<br>B) Presence of leukocyte esterase and nitrites<br>C) High levels of protein<br>D) Presence of red blood cells without bacteria | **1.5** | **CO 1** |
| **17** | **This enzyme is critical for the elongation step during PCR:**<br><br>A) DNA polymerase<br>B) Ligase<br>C) Reverse transcriptase<br>D) RNA polymerase | **1.5** | **CO 1** |
| **18** | **In an ELISA, which of the following is used to detect the presence of the enzyme-substrate reaction?**<br><br>A) Radioactive isotopes<br>B) Fluorescent dyes<br>C) Color change<br>D) Electrochemical signals | **1.5** | **CO 1** |
| **19** | **Which of the following is NOT a common application of PCR.**<br><br>A) DNA cloning<br>B) DNA fingerprinting<br>C) Gene therapy<br>D) Diagnosing infections through pathogen detection | **1.5** | **CO 1** |
| **20** | **_____ is a key component of the PCR reaction mix.**<br><br>A) Reverse primers only<br>B) RNA polymerase<br>C) DNA primers, nucleotides, and a heat-stable DNA polymerase<br>D) Antibodies against the DNA target | **1.5** | **CO 1** |
| **Section B** | | | |

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| **(4Qx5M=20 Marks)** | | | |
| **Q 1** | Discuss various methods of immobilizing enzymes on biosensor surfaces. | **5** | **CO 2** |
| **Q 2** | Write the key principles and steps involved in the collection and processing of blood specimens for laboratory analysis. | **5** | **CO 2** |
| **Q 3** | Describe the normal regulation of blood glucose levels. | **5** | **CO 2** |
| **Q 4** | Explain the principle behind Polymerase Chain Reaction (PCR). What are the key steps involved in a typical PCR cycle? | **2+3** | **CO 2** |
| **Section C<br>(2Qx15M=30 Marks)** | | | |
| **Q 1** | A 38-year-old female with a history of recurrent episodes of joint pain and swelling, particularly in her knees and elbows, presents with another acute episode. Her past medical history includes hypertension and obesity. Blood tests show elevated uric acid levels. However, the patient has no significant dietary history of purine-rich foods or alcohol. Joint aspiration is negative for crystals.<br><br>A) Discuss the key pathological features of gout, and explain why joint aspiration is crucial for diagnosis. (5)<br>B) This patient's joint aspiration was negative for urate crystals. What other conditions should be considered in the differential diagnosis of her symptoms? (5)<br>C) Discuss how this patient's comorbidities, such as obesity and hypertension, may influence her uric acid levels and increase the risk of gout. (5) | **15** | **CO 3** |
| **Q 2** | A 6-month-old infant is brought to the pediatric clinic due to concerns about hypoglycemic episodes. The parents report that the baby has been experiencing episodes of irritability, sweating, and shaking, especially after overnight fasting or prolonged periods between feeds. The child has been growing at an accelerated rate but has been slow to develop motor skills. Routine laboratory tests show hypoglycemia.<br><br>A) Describe the pathophysiology of Glycogen Storage Disease Type I (Von Gierke Disease) and explain how the enzyme deficiency leads to hypoglycemia. (5)<br>B) Define the role of the enzyme glucose-6-phosphatase in normal glucose homeostasis, and how does its deficiency in Von Gierke disease disrupt normal metabolism? (5)<br>C) Explain the dietary changes, which are necessary for the long-term management of this condition? (5) | **15** | **CO 3** |
| **Section D<br>(2Qx10M=20 Marks)** | | | |
| **Q 1** | A) Describe the principle of ELISA (Enzyme-Linked | **5+5** | **CO 3** |

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| | Immunosorbent Assay).<br>B) Discuss its various types, including their applications and limitations. | | |
| **Q 2** | A) Write the working principle, types, and applications of biosensors in brief.<br>B) Discuss the role of biosensors in healthcare. | **5+5** | **CO 3** |