Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Bioinstrumentation **Semester: IV**
Program: B.Sc. (Microbiology) **Time: 03 hrs.**
Course Code: HSCC2026 **Max. Marks: 100**

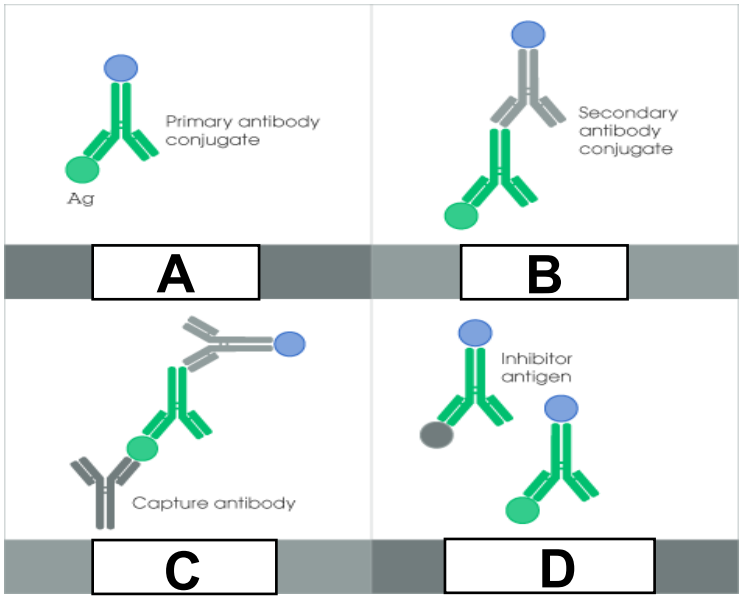
Instructions: Read question carefully.

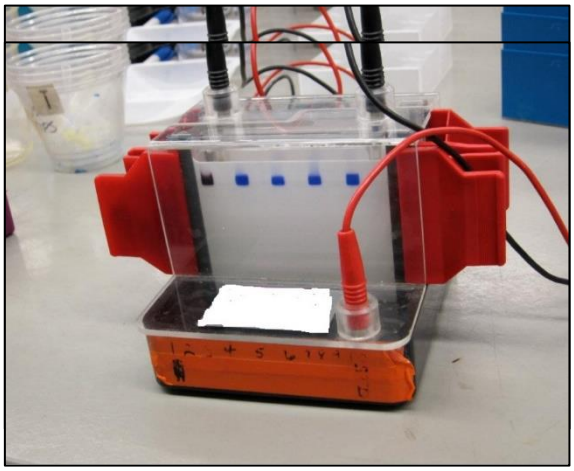
SECTION A

S. No.	MCQ's /Fill in the blanks/ True & False (1.5 marks each)	**30 Marks**	**CO**
1	**What is the correct order of the three steps of PCR?** A) Extension, denaturation, annealing B) Denaturation, annealing, extension C) Melting, adhesion, polymerization D) Melting, extension, polymerization	**1.5**	**CO3**
2	**Which of the following reagents are used to precipitate DNA?** (a) Isopropanol (b) Ethanol (c) Both a and b (d) None of the above	**1.5**	**CO3**
3	**Why are vent polymerase and Pfu more efficient than the Taq polymerase?** (a) Because of proofreading activity (b) Because of more efficient polymerase activity (c) Both a and b (d) None of the above	**1.5**	**CO3**
4	**The pH at which a protein carries a net zero charge is termed which of the following?** a) pK_a b) pK_b c) pI d) K	**1.5**	**CO3**
5	**Which of the following does not act as a restriction enzyme?** a) EcoRI b) BamHI	**1.5**	**CO3**

	c) HindIII d) BSA		
6	**The process of passing a mobile phase through a chromatography column is called which one of the following?** a) Flushing b) Washing c) Elution d) Partitioning	**1.5**	**CO3**
7	**What is the first stage of the two-stage two-dimensional PAGE?** a) SDS-PAGE b) HPLC c) Isoelectric focusing d) Sedimentation	**1.5**	**CO3**
8	**Which of the following statements is true?** a) Exonuclease III removes nucleotide residues from the 3' ends of a DNA strand b) Bacteriophage lambda exonuclease removes terminal phosphates c) Alkaline phosphatase removes nucleotides from 5'ends d) Kinase adds homopolymer tails to the 3' –OH ends of a linear duplex	**1.5**	**CO3**
9	**Which of the following is true about restriction endonucleases?** a) Type I and II requires ATP to move along DNA b) Type I, II and III requires ATP to move along DNA c) Type II requires no ATP and cleaves DNA within recognition sequence d) Type II requires ATP and cleaves DNA within recognition sequence	**1.5**	**CO3**
10	**Isopyknic or equal density centrifugation is achieved in** **a)** Buoyant density centrifugation **b)** Density gradient centrifugation **c)** Electrophoresis **d)** Differential centrifugation	**1.5**	**CO1**
11	**The technique used in the detection of particular protein is** **a)** Buoyant density centrifugation **b)** Density gradient centrifugation **c)** Immuno-electrophoresis **d)** Both B and C	**1.5**	**CO1**
12	**During Transformation of Plasmid DNA into bacterial cells, which of the following chemicals is added?** a) $MgCl_2$ b) $CaCl_2$ c) NaCl d) HCl	**1.5**	**CO2**
13	**Ultrastructure of a cell organelle can best be studied through** **a)** Microdissection **b)** Electron microscope **c)** Phase-contrast microscope **d)** Autoradiography	**1.5**	**CO1**
14	**Buoyant density centrifugation is carried out at centrifugal force of** **a)** 50,000 g for 1 – 3 hours **b)** 50,000 g for 20 hours **c)** 1,00,000 g for 1 – 3 hours **d)** 1,00,000 g for 20 hours	**1.5**	**CO1**

15	**Organelles can be separated from cell homogenate through** **a)** Chromatography **b)** X-ray diffraction **c)** Differential/density gradient centrifugation **d)** Auto-radiography	**1.5**	**CO1**
16	**Which of these is/are the property of real-time PCR assays?** **A.** Incorporate dyes that bind double-stranded DNA. **B.** Incorporate an internal hydrolysis probe. **C.** Be performed at a single temperature with no specialized instrumentation required. **D.** Be interpreted as a plus/minus result or as a quantitative result.	**1.5**	**CO2**
17	**Labelled Antibodies are used to detect** **A.** Presence of particular DNA molecule in Southern Blotting **B.** Presence of particular RNA molecule in Southern Blotting **C.** Presence of particular protein molecule in Southern Blotting **D.** Presence of particular protein molecule in Western Blotting	**1.5**	**CO2**
18	**In SDS-PAGE, protein sample is first treated with detergent sodium dodecyl sulfate (SDS), in order to** a) Make the protein become negatively charged. b) Make the protein become positively charged. c) Renature the protein. d) Adjust the pH of protein.	**1.5**	**CO2**
19	What is a DNA Probe?	**1.5**	**CO2**
20	**Which of the following technique doesn't involve electrophoresis of Biomolecules?** **A.** Dot Blotting **B.** Southern Blotting **C.** Northern Blotting **D.** Western Blotting	**1.5**	**CO2**
	SECTION B (5 marks each question)		
Q	Short Answer Type Question (5 marks each) Scan and Upload 4 questions 5 marks. Word limit (100-120)	**20 Marks**	**CO**
1	Mention the difference between Rate-zonal and Isopycnic centrifugation.	**5**	**CO1**
2	Match in correct order **A.** Southern Blotting **1.** Expression of mRNA **B.** Western Blotting **2.** DNA-DNA Hybrid **C.** Northern Blotting **3.** DNA vs. DNA **D.** DNA fingerprinting **4.** Antigen-Antibody **E**. Real Time PCR **5.** DNA-RNA Hybrid	**5**	**CO2**
3	**A.** Name different types of PCR. **B**. Mention the applications of PCR.	**5 (2+3)**	**CO3**
4	Differentiate between a Light Microscope and Electron Microscope.	**5**	**CO1**
	SECTION C 30 marks		
Q	**Two case studies 15 marks each subsections**	**30 Marks**	**CO**

1	Case Study 1 (Word limit-250-300) You are amplifying a portion of blood group antigen binding adhesin A (BabA) gene from *Helicobacter pylori* by polymerase chain reaction (PCR). The organism was isolated from the stool samples of an infected individual. After the agarose gel electrophoresis of amplified PCR products, you observed non-specific amplification or smear. **Q1:** What could be the reasons behind the observation? **Q2:** How are you going to troubleshoot the problem? **Q3:** What is primer dimer? **Q4:** What is nested PCR? **Q5:** What could be purpose of adding bovine serum albumin (BSA) was added in a PCR reaction?	**15 (4+4+2 +3+2)**	**CO3**
2	Case Study 2 (Word limit- 250-300) Assume that you would like to clone your target gene within a suitable vector. During cloning process, you are facing the following issues: **A.** The digested DNA ran as a smear on an agarose gel. **B.** Additional bands in PCR reaction other than desired one. **C.** Few or no transformants How are you going to troubleshoot each of the above problems?	**15 (5x3)**	**CO1**
	SECTION- D 20 marks		
Q	Long Answer type Questions Scan and Upload (10 marks each) Word limit 200-250	**20 Marks**	**CO**
1	 **Q1:** Identify the diagnostic method from the above figure. **Q2:** Identify the diagnostic methods "A", "B", "C" and "D". **Q3:** Mention the basic difference among "A", "B", "C" and "D". **Q4:** Write note on the application of "C" and "D".	**10 (1+2+5 +2)**	**CO3**

2	 **Q1:** Identify the name of method from the above figure. **Q2:** Write the working principle of this method. **Q3:** What are the applications of the method?	**10** **(1+6 +3)**	**CO3**