Name:

Enrolment No:

UPES

End Semester Examination, May 2025

Course: Introduction to Biomedical Engineering

Semester: 2

Program: BT-BIOMEDICAL ENGINEERING

Duration: 3 Hours

Course Code: HSBE1001 **Max. Marks: 100**

Instructions: Attempt all the questions

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	**Which of the following best describes the role of a biomedical engineer?** A. Conducts surgeries B. Designs and maintains medical equipment C. Prescribes medication D. Performs diagnostic imaging	1.5	CO1
Q 2	**Which imaging technique uses strong magnetic fields and radio waves?** A. PET B. X-ray C. MRI D. Ultrasound	1.5	CO2
Q 3	**The main block of a medical instrumentation system includes:** A. Amplifier only B. Sensor, signal processor, display C. Microphone and speaker D. Imaging device only	1.5	CO1
Q 4	**What is the primary source of biomedical signals?** A. Electrical signals from machines B. Signals from medical databases C. Physiological activities in the human body D. Mechanical sensors	1.5	CO3
Q 5	**Which technique is used to detect specific DNA sequences?** A. MRI B. PCR C. EEG D. X-ray	1.5	CO3

Q 6	**SELEX is used to:** A. Diagnose cardiac issues B. Select RNA aptamers from a random library C. Enhance X-ray resolution D. Purify proteins	**1.5**	**CO5**
Q 7	**An ECG primarily measures:** A. Brain waves B. Muscle tension C. Electrical activity of the heart D. Kidney function	**1.5**	**CO5**
Q 8	**Which of the following is a common ethical body in biomedical research?** A. WHO B. IEEE C. Institutional Review Board (IRB) D. FDA	**1.5**	**CO2**
Q 9	**3D bioprinting is especially useful in creating:** A. Electrical circuits B. Artificial organs and tissues C. Chemical sensors D. Data models	**1.5**	**CO2**
Q 10	**Which of the following is a non-invasive diagnostic imaging technique?** A. Endoscopy B. Ultrasound C. Biopsy D. Laparoscopy	**1.5**	**CO1**
Q 11	**Which device is used to maintain breathing in critical patients?** A. Dialyzer B. Defibrillator C. Ventilator D. Pacemaker	**1.5**	**CO1**
Q 12	**The function of RNA aptamers is to:** A. Encode genetic traits B. Bind specific molecular targets C. Form cell walls D. Act as antibiotics	**1.5**	**CO5**
Q 13	**Ethical issues in biomedical engineering include all EXCEPT:** A. Patient consent B. Data fabrication C. Equipment cost D. Emergency use trials	**1.5**	**CO4**
Q 14	**Thermal imaging is primarily used to detect:** A. Body fat	**1.5**	**CO5**

	B. Temperature distribution C. Bone fractures D. Brain waves		
Q 15	**Cryopreservation is used in biomedical research to:** A. Heat biological tissues B. Preserve tissues/cells at very low temperatures C. Stimulate cell growth D. Remove DNA	**1.5**	**CO2**
Q 16	**Which of the following represents a 2D cell culture?** A. Cells grown in a tissue scaffold B. Cells suspended in gel C. Cells grown on a flat dish D. Cells in a microfluidic device	**1.5**	**CO2**
Q 17	**An artificial kidney is used in the process of:** A. Respiration B. Dialysis C. Heart rhythm control D. Imaging	**1.5**	**CO3**
Q 18	**Which machine delivers electric shocks to revive a stopped heart?** A. ECG B. Pacemaker C. Defibrillator D. Dialyzer	**1.5**	**CO3**
Q 19	**Which of the following is NOT part of Good Laboratory Practices (GLP)?** A. Documentation B. Staff training C. Hypothesis formation D. Equipment calibration	**1.5**	**CO5**
Q 20	**Organ-on-a-chip systems are primarily used for:** A. Delivering drugs B. Modeling organ functions for research C. Organ transplant D. Producing stem cells	**1.5**	**CO1**
Section B (4Qx5M=20 Marks)			
Q 1	Imagine you are designing a portable ECG device for rural health camps. What features would you prioritize to ensure both functionality and affordability? Justify your choices.	**5**	**CO3**
Q 2	Explain how the concept of ‘organ-on-a-chip’ could revolutionize drug testing and reduce dependency on animal models.	**5**	**CO4**
Q 3	Describe the ethical concerns associated with emergency use of experimental medical devices in critical care scenarios.	**5**	**CO5**

Q 4	Design a basic experimental setup using PCR and aptamer binding assays to detect a viral infection from a patient's blood sample.	**5**	**CO2**
Section C **(2Qx15M=30 Marks)**			
Q 1	"3D printing and organ-on-a-chip technologies have the potential to eliminate the need for animal testing." Do you agree or disagree? Justify your answer with examples, explaining the science behind these technologies and their current limitations.	**15**	**CO2**
Q 2	Explain the working of an ECG machine, including the basic block diagram. *(7.5 Marks)* Discuss how abnormalities in ECG signals can help in diagnosing heart-related problems. *(7.5 Marks)*	**15**	**CO4**
Section D **(2Qx10M=20 Marks)**			
Q 1	What are the ethical challenges faced in the development and deployment of medical devices? *(5 Marks)* Discuss with examples how bioengineers can ensure safety and public trust in healthcare innovations. *(5 Marks)*	**10**	**CO5**
Q 2	Describe the differences between X-ray, MRI, and Ultrasound imaging techniques. *(5 Marks)* Include their working principles, common uses in medical diagnosis, and any advantages or disadvantages. *(5 Marks)*	**10**	**CO2**