Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

I SEM M. Tech (BME) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC-2023
SUBJECT: ADVANCED BIOMEDICAL INSTRUMENTATION (BME 5112)
(REVISED CREDIT SYSTEM)
Thursday, 30th November, 2023; 9.30 AM- 12.30 PM

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to Candidates:

1. **Answer ALL questions**
2. **Draw diagrams wherever necessary**
3. **Missing data may be suitably assumed**

1 a.	With a neat figure, illustrate how photo resistors can be used to measure pulse of a subject.	5
1 b.	A strain gauge having a gauge factor of 2.1 and resistance of 120.2Ω is glued to a structure. As the structure is subject to a stress, the resistance changes to 120.25Ω. Calculate the strain and the stress applied on the structure. (Given: Young's modulus, E = 205GPa).	3
1c.	Differentiate suction cup electrodes from floating electrodes. Also indicate if there is any advantage of using microelectrode for ECG recording as compared to surface electrodes.	2
2 a.	Recommend a type of defibrillator that would be ideal to treat the condition of tachycardia. Justify your answer and explain the specific type of defibrillator in detail.	5
2 b.	In the case of an ideal square wave defibrillator, determine the energy delivered to the patient. The ideal square wave pulse discharged by the defibrillator has amplitude of 2000V for 5msec duration. Assume skin electrode resistance = 25Ω, internal resistance of the defibrillator= 5Ω and thorax resistance =30Ω].	3
2c.	Interpret the code 'VOO' and explain the pacemaker which is identified by this code.	2
3 a.	Define 'Doppler effect and illustrate with a neat figure, the non-invasive technique of measuring blood flow velocity.	5
3 b.	Explain in detail the patient breathing and humidification systems in an anesthesia machine.	3
3 c.	Describe the principle of bubble and membrane oxygenator and their comparison in detail.	2

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4 a.	Explain the heart-lung machine's working principle and design aspects with a block diagram.	5
4 b.	Describe the A, M, and B scan modes of ultrasonography in detail.	3
4 c.	Illustrate and explain the principle of anger camera (gamma camera).	2
5 a.	Demonstrate the difference between T1 and T2 weighted Magnetic Resonance Imaging with an example of brain imaging. Suggest contrast agents for MRI.	5
5 b.	Justify the need for multimodal imaging in biomedical. Suggest a multimodal imaging platform that can be used to obtain structural images along with metabolic or biochemical functions.	3
5c.	Explain the principle and advantages of two-photon microscopy for biomedical imaging.	2