Reg. No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

II SEMESTER B.S. DEGREE EXAMINATION

SUBJECT: ELEMENTS OF BIOMEDICAL ENGINEERING (BM121)

(BRANCH: BIOMEDICAL)

Wednesday, 3 May 2017

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Assume relevant data if missing.**
- ✓ **Draw diagrams wherever necessary.**

1. (a) Simplify the Boolean function using KMap method. (6)

   F (A, B, C, D) = ∑ m (0, 2, 3, 4, 6, 8, 10, 11, 12, 14)

   (b) Design an asynchronous decade counter using JK Flipflops. (8)

   (c) Perform the following subtractions using 1's and 2's complements. (6)

   (i) $11010_2 - 10000_2$ (ii) $11010_2 - 1101_2$ (iii) $100_2 - 11000_2$

2. (a) With neat diagrams, explain the working of PN diode under forward and reverse biased conditions. Draw and explain its V-I characteristics. (7)

   (b) What is the major difference between photodiode and LED? Give the construction, working principle and two applications of LED. (6)

   (c) What is Junction Field Effect Transistor (JFET)? With a neat diagram, explain its construction details and operation. (7)

3. (a) What is virtual ground with reference to an op-amp? Illustrate. (4)

   (b) What are the characteristics of an ideal operational amplifier? (6)

   (c) Draw an op-amp open-loop and closed loop inverting amplifier circuit and derive expressions for gain of the amplifier in both configurations. (10)

4. (a) What is bio-metrics? List and explain all essential factors to be considered in biomedical instrumentation. (8)

   (b) With help of a block diagram explain different components of "man-instrument" system. (6)

   (c) What is electrode-electrolyte interface? Explain. (6)

5. (a) Simplify the given expression using Boolean algebra techniques. (2)

$[A\bar{B}(C + BD) + \bar{A}\bar{B}]C$

(b) List and explain various bio-potential recording electrodes. (12)

(c) Design a 3–input op-amp summing amplifier with a gain of 1. (6)

6. (a) What is a Flipflop? Give the logic diagram and truth table of a JK Flipflop. (8)

(b) An op-amp inverting amplifier has R_F = 5KΩ, and R_G = 10KΩ. Compute the closed loop gain of the amplifier, and the output voltage, if the input voltage is -3 V. (5)

(c) Realize the following Boolean function using 8x1 MUX. (7)

$F(A\ B\ C\ D) = \sum 1, 2, 4, 5, 6, 8, 10, 11, 12, 14$

7. (a) Draw typical electrocardiogram and explain different waves present in it. (2+6)

(b) What is a Half adder? Design a half adder using minimum number of NAND gates. (5)

(c) Design a 4-bit binary adder-subtractor circuit. (7)

8. (a) What is Zener break down? With a neat diagram, describe a reverse biased Zener diode and its reverse characteristics. (6)

(b) With a neat diagram, describe how a NPN transistor is biased. List two important applications of BJT. (6)

(c) How do you make use of Electromyogram to measure sensory nerve conduction velocity? (8)