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MANIPAL INSTITUTE OF TECHNOLOGY
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*(A constituent institution of MAHE, Manipal)*

**I SEMESTER M.TECH. (INDUSTRIAL AUTOMATION AND ROBOTICS)**

**END SEMESTER EXAMINATIONS, NOV-DEC 2018**

**SUBJECT:** ANALOG AND DIGITAL ELECTRONICS **[**MTE 5131]
24/11/2018

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ALL** the questions.
- Data not provided may be suitably assumed

**1A.** Compare an ideal OP-AMP with a practical OP-AMP in terms of gain, input impedance & bandwidth, and formulate the overall gain of an inverting amplifier. **03**

**1B.** Subtract $(6)_{10}$ from $(5)_{10}$ using 2's complement method. **03**

**1C.** Design a negative edge triggered 4-bit asynchronous up Binary Counter. **04**

**2A.** Design a 4-bit Binary to BCD code converter. **04**

**2B.** Construct a FM demodulator/detector using phase locked loop. **06**

**3A.** Design a combinational logic circuit for a mobile robot which follows a black line. The robot is embedded with four infrared sensors, were first & fourth sensors are placed to sense outside black line and second & third sensors are placed to detect black line for achieving forward motion. If the condition is not satisfied then the robot should stop. **05**

**3B.** Discuss the data movement in a 4-bit bidirectional shift register using state timing diagrams. (Take data to be loaded as 1011). **05**

**4A.** Design the circuits using OP-AMP to perform the following operations: **05**

a. $V_{out} = \frac{K_B T}{-q}[In(V_i) - In(RI_a)]$

b. $V_{out} = -RI_a e^{\frac{-qV_i}{K_B T}}$

**4B.** Add the following binary numbers and represent the result in 2's complement form: **05**

a. 10101110 and 100111
b. 10010010 and 110011
c. 11001001 and 111110

**5A.** In an operational amplifier as shown in **Fig 5(A)**, if $V_1$=10V, $V_2$=20V, $R_1$=$R_2$=Rg=1Kohm and $R_f$=1Kohm then calculate the feedback current. **02**

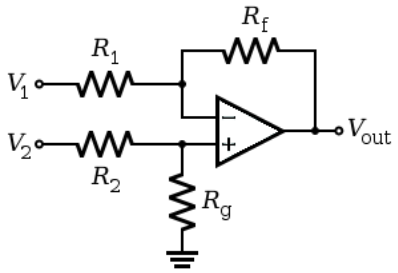


**fig 5(A)**

**5B.** Explain the cyclic codes and recall the applications of cyclic codes in error detection & correction. **03**

**5C.** Design a serial transfer logic diagram and explain the implementation of 4-bit register to 4-bit register serial data transfer. **05**