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# MANIPAL INSTITUTE OF TECHNOLOGY (A Constituent Institute of Manipal University) Manipal – 576 104



**MAX. MARKS: 100** 

## IV SEMESTER B.Tech. (BME) DEGREE END SEM EXAMINATIONS MAY, 2016

#### SUBJECT: INTEGRATED CIRCUIT SYSTEMS (BME 2202) (REVISED CREDIT SYSTEM) Saturday, 7<sup>th</sup> May, 2016, 2 to 5 pm.

#### **TIME: 3 HOURS**

# Instructions to Candidates:

### 1. Answer ALL questions.

- 2. Draw labeled diagram wherever necessary
  - 1A) Draw the circuit of a differential amplifier with a constant current source and (6) explain how  $I_0$  is constant in this circuit.
  - 1B) For the circuit shown in Fig. Q1B, if  $R_i = \infty$ , Show that the output admittance, (6)

$$Yof = \frac{1}{R+R^{1}} + \frac{1}{R_{o}} \left[ 1 - A_{V} \frac{R}{R+R^{1}} \right]$$



- 1C) Draw the circuit of an instrumentation amplifier suitable for amplifying EEG (8) signals with a gain of 10000. Derive the expression of the overall gain of the circuit and calculate the values of all components.
- 2A) Draw the circuit of a RC active band pass filter. Derive the expression of the (8) transfer function  $A_V(s) = \frac{V_o(s)}{V_s(s)}$
- 2B) Design and draw the circuit of  $3^{rd}$  order active Butterworth filter to pass the EMG (8) signals between the frequency 200 Hz to 2Khz. The maximum gain of the filter is 50. The Butterworth polynomial given is,  $(s^2 + s + 1)(s + 1)$
- 2C) Design and draw the circuit using Op-Amps to obtain the following expression. (4)  $V_o = 25V_1 + 100V_2 - 40V_3$

- 3A) What is precision diode? Draw the circuit of a full wave precision rectifier and (6) explain its operation.
- 3B) Design and draw the circuit of a regulated power supply for the following (8) specifications. Vo can be varied between 12 volts to 14 volts. Input available is 230 volts, 50 Hz ac. The maximum load current is 1Ampere. Assume, the ripple factor for the capacitor filter is 8%. Use IC 7809.
- 3C) Briefly discuss on switching regulators.

(6)

- 4A) Draw the internal circuit diagram of timer IC 555. Explain the functions of each (6) pin of the IC.
- 4B) Draw the circuit diagram of mono-stable multi-vibrator using Timer IC. Explain its (6) operation with relevant waveforms. Derive the expression of pulse width  $t_P$ .
- 4C) Design and draw the suitable circuits using timer IC to generate the following (8) waveforms Vo<sub>1</sub> and Vo<sub>2</sub>, shown in Fig.Q4B. The time intervals of V<sub>o1</sub> are,  $T_1=T_2=$ Seconds and the time intervals of V<sub>o2</sub> are,  $t_{ON} = t_{OFF}$



- 5A) Draw the circuit of a 4 bit ladder type digital to analog converter. Derive the (8) expression of the output and calculate analog output with a reference voltage of +6 volts.
- 5B) With a suitable diagram explain the operation of a counter ramp type ADC. (6) Mention its merits and demerits.
- 5C) Draw the internal diagram of VCO IC566. Explain the operation with suitable (6) waveforms and give the expression of frequency of output waveform.