Reg. No.										

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

III SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS

LINEAR INTEGRATED CIRCUITS AND APPLICATIONS [MTE 2104]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. With necessary mathematical expression, elucidate how IC 555 timer can be utilized to design a circuit of 50% duty cycle. **04**

1B. Explain the working principle of the fastest Analog to Digital Converter to get a 3-bit digital word as the output. **03**

1C. Design a Phase Locked Loop circuit using IC 565 to get free running frequency of 4.5kHz; lock range of 2 kHz and capture range of 100Hz having the supply voltage of ±10V. **03**

2A Determine the output voltage (V_{out}), if the op-amp in Fig. Q2A is ideal. **02**

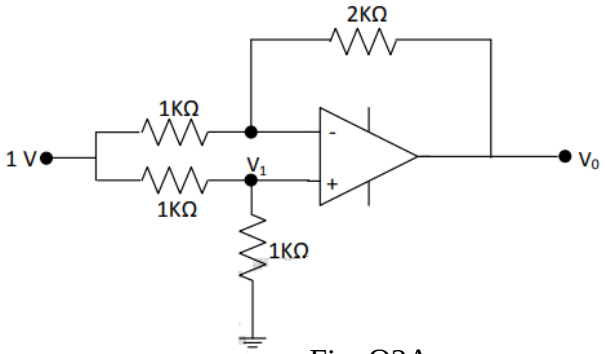

Fig. Q2A

2B Design a wide band reject filter of lower cut-off frequency f_h= 2kHz, f_l = 400Hz and pass-band gain is 2. Also, draw the graph defining pass-band region and stop-band region. **04**

2C Design 4-bit R-2R ladder type DAC. Compute the full-scale voltage and % resolution of a 5-bit DAC. **04**

3A Explain the working of Phase Locked Loop circuit using its functional block diagram, and also explain about the three stages of its operation. **03**

3B Design an inverting adder circuit using op-amp to get the output expression given below. V_1, V_2, V_3 are inputs. Assume R_F =10kΩ. **03**

$$V_0 = -(0.5V_1 - V_2 + 10V_3)$$

3C For the IC 566 Voltage Controlled Oscillator shown in Fig. Q3C, V_{CC} =10V, R_T =10kΩ , R_1=1.2kΩ, R_2=10kΩ. Compute: a) Frequency output (f_o) b) Voltage to frequency conversion factor c) Variation in f_o if modulation input voltage, V_c is varied between 7.7V and 9.5V, d) List out any two application of the circuit **04**

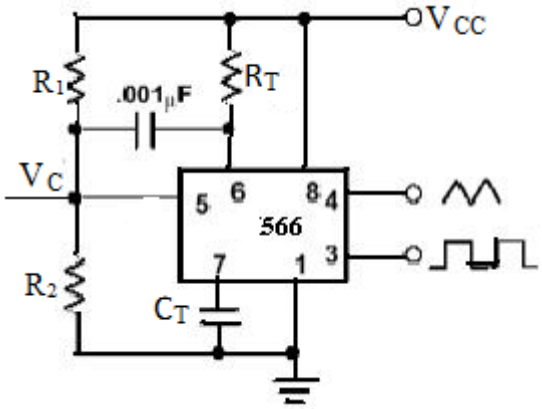

Fig. Q3C

4A With the help of necessary circuit diagrams, elucidate the advantages of practical integrator over simple integrator and also, explain their frequency responses. **03**

4B Describe how 78xx fixed series can be used as Adjustable regulator and derive output voltage equation. Using IC 7805, design a current source to deliver 0.15 A to a 20Ω resistor, 5 Watt load. (Quiscent current,I_Q=4.2mA for IC 7805). Also, calculate V_{in} if drop-out voltage, V_D=2V. **04**

4C Construct an electronic circuit using op-amp which can be utilized to sample the incoming analog signal and holds its value at a stable level for a particular period of time. **03**

5A Explain the operation of Shunt voltage regulator using functional block diagram. State the difference between Load Regulation and Line Regulation. **04**

5B Design a circuit using op-amps to solve the following differential equation: **03**

$$K_1 \frac{dV1}{dt} + K_2V_1 - V_2 = 0$$

5C In an electronics laboratory, the measuring instrument is capable of measuring voltages only, but the output of the photodiode sensor is a current which changes proportional to the light intensity. Explain how op-amp can be used to convert the output current of photodiode into voltage. **03**