Reg. No.										

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

III SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, DEC-2018

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. Design an astable multivibrator (using 555 Timer) to generate frequency of 20kHz and duty cycle of 75%. The output of multivibrator is to be connected to counter only for 2 seconds. (Hint: To perform this task , another multivibrator along with digital logic can be used) **04**

1B. Suggest an ADC which involves the concept of integration and de-integration. Explain its operation with the help of circuit diagram and necessary mathematical expression. **03**

1C. Design a Phase Locked Loop circuit for 100kHz free running frequency, supply voltage ± 6V, demodulation capacitor is 1µF and compute the capture range and lock range of PLL. **03**

2A To build a simple light meter, an LDR (Light Dependent Resistor) is connected in circuit as shown in Fig Q2A. In bright sunlight, LDR has a resistance of 1kΩ. In shade, its resistance increases to 15kΩ. Determine the voltages that would appear on the voltmeter in both the conditions. **02**

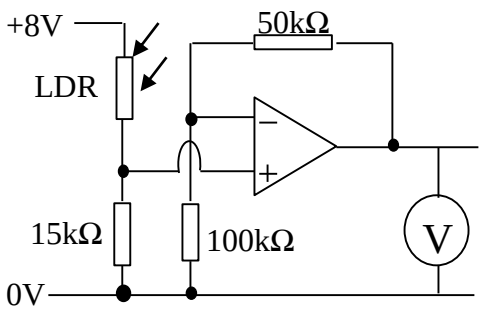

Fig Q2A

2B Design a -40dB/decade band reject filter having f_h = 400 Hz and f_l = 2kHz with pass band gain of 2. **04**

2C Consider 4-bit R-2R data converter having R=10kΩ , V_{ref} = 10V; calculate R_f values under the following circumstances: **04**
a)The value of first LSB at the output is 0.5V
b)An analog output of 6V for binary input of $(1000)_2$
c) The full scale output voltage 12V
d) Actual maximum output voltage of 10V

3A Demonstrate any one application of Phase Locked Loop circuit with necessary diagram and mathematical expression which manipulates the frequency of an input signal. **03**

3B Compute the output voltage, V_o for the circuit shown in Fig. Q3B **03**

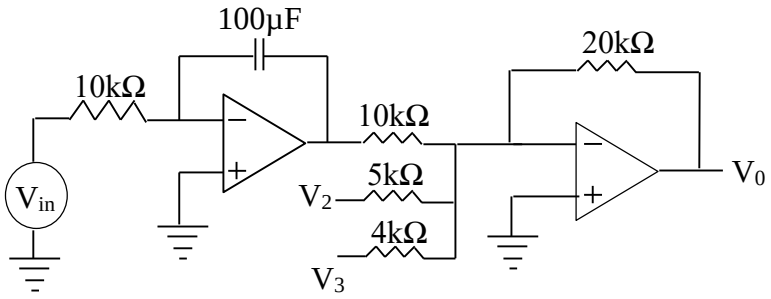

Fig. Q3B

3C Using IC 566, design a Voltage Controlled Oscillator with an output frequency 2kHz and modulating input voltage 9V. Calculate the value of timing-resistance (R_T), which can control the charging-discharging of the capacitor. Also, calculate the variation in free-running frequency if the modulating voltage is varied from 7.8V to 9.6V. Draw the output if the modulating input is a sine wave. V_{CC} =+10V. Assume all capacitors to be 0.01µF. **04**

4A Calculate the output voltage V_0 for the circuit shown in Fig. Q4A **03**

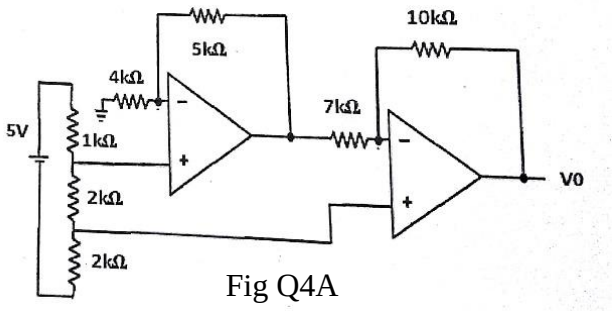

Fig Q4A

4B Derive output voltage equation for IC LM 317 regulator using its functional diagram and calculate its output range in which output voltage can be varied using the following data :R_1 = 820Ω and Rpot = 10kΩ potentiometer. [Given I_Q = 100µA] **04**

4C Design a suitable air conditioning circuit using Op-Amp to maintain a stable temperature range between 18 to 24 degrees for a domestic central heating systems. The temperature of the room air is not only heated when the temperature is too low but the air can also be cooled when the temperature is too high. **03**

5A Design a current source to deliver 0.15A current to 10Ω, 10 watt load using IC 7805 (Three terminal regulator).The Quiescent current (I_q) for 7805 is 4.2mA. **03**

5B Design following the differerntial equation using minimum number of op-amps: **04**

a) $5\frac{dV_1}{dt} + 7\,V_1 - 3\,V_2 = 0$

b) $\frac{d^2V_i}{dt^2} + 5\frac{dV_i}{dt} - 10\,V_i = 20$

5C Determine the load regulation for a circuit shown in Fig .Q5A with the parameters of Zener diode ; P_{max} = 260mW and minimum conduction current =0.6mA. **03**

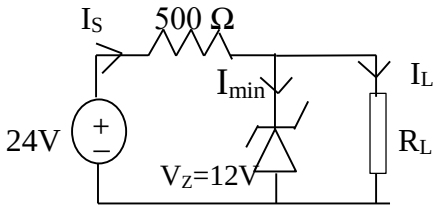

Fig Q5A