Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–V • EXAMINATION – SUMMER 2013**

**Subject Code: 151003 Date: 16-05-2013**

**Subject Name: Integrated Circuits and Applications**

**Time: 10.30 am - 01.00 pm Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** 1. Draw block diagram of a typical op-amp and explain functions of each block. **04**

2. Define followings for an op-amp: (i) input offset current (ii) CMRR (iii) Differential input resistance. **03**

**(b)** What type of feedback is present in the non-inverting amplifier? Derive expression for voltage gain, input resistance, output resistance and bandwidth of a non-inverting amplifier using a non ideal op-amp. **07**

**Q.2** **(a)** 1. Draw inverting amplifier. Determine the maximum output offset voltage due to (i) input offset voltage Vio and (ii) input bias current $I_B$. Take Vio max = 6 mV dc, $I_B$ max = 500 ḍA dc, Vs = ± 15 V, $R_F$ = 47 kÝ and $R_1$ = 470 Ý. **04**

2. What is slew rate? List causes of slew rate. Also explain its significance in applications. **03**

**(b)** Draw peaking amplifier specify the value of all components to provide a gain of 10 at a peak frequency of 16 KHz. Take L = 10 mH with internal resistance of 30 Ý. **07**

**OR**

**(b)** What is an instrumentation amplifier? Explain with the help of neat diagram the operation of an instrumentation amplifier employing three basic op-amps and with provision for variation in the voltage gain. **07**

**Q.3** **(a)** Draw the non-inverting Schmitt trigger comparator circuit and explain the threshold levels and hysteresis. **07**

**(b)** Draw asymmetrical square-wave generator circuit using op-amp. Specify suitable component value for the following specification: $T_{ON}$ = 1 sec. $T_{OFF}$ = 2 sec. Assume value of ß = 0.1 and C = 100 µF. **07**

**OR**

**Q.3** **(a)** Explain in detail operation of full-wave precision rectifier with neat diagram and waveform. **07**

**(b)** Draw basic log amplifier using a transistor. Derive the expression for output voltage. Also state disadvantages of circuit. **07**

**Q.4** **(a)** Design second order Butterworth low pass filter with ï 3 dB frequency of 10 KHz. Choose C = 1 ḍF. ( Use equal component KRC filter circuit) **07**

**(b)** With the help of a circuit diagram explain the operation of first order high-pass filter. **07**

**OR**

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | Design a wide-band band pass filter using a single op-amp for $f_L$ = 100 Hz, $f_H$ = 1 KHz and pass band gain of 4. Also calculate the value its quality factor Q. | **07** |
| **Q.4** | **(b)** | Derive the expression for filter transfer function of a first order low-pass filter and draw its frequency response characteristics. | **07** |
| **Q.5** | **(a)** | Design a free running ramp generator using IC 555 for Vcc=10 V, C= 0.1µF and period T= 2 ms. Take transistor with ß = 100. Explain its working. | **07** |
| | **(b)** | Draw block diagram of the PLL system and explain function of each block. State the applications of PLL. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Draw circuit diagram of an astable multivibrator using IC 555 and explain its operation. Derive expression for frequency of operation and duty cycle. | **07** |
| | **(b)** | Draw block diagram of a basic SMPS and explain it. Also state advantages and disadvantages of SMPS. | **07** |

**********