

GUJARAT TECHNOLOGICAL UNIVERSITY
B.E SEM-V Examination-Nov/Dec.-2011

Subject code: 151003

Date: 24/11/2011

Subject Name: Integrated Circuits and Application

Time: 02.30 pm-05.00 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) (i) Draw and explain the block diagram of Op-Amp. **07**
(ii) What are the characteristics of an ideal op-amp? Draw its equivalent circuit along with voltage transfer curve.
(b) Derive the formula for voltage gain, input resistance, output resistance **07**
and bandwidth for voltage series feedback amplifier using op-amp.

- Q.2** (a) Explain the application of op-amp as a subtractor and summing **07**
amplifier using differential configuration.
(b) The op-amp is used as an inverting amplifier, with the following **07**
specifications:

$$\frac{\Delta V_{io}}{\Delta T} = 30 \mu\text{V}/^\circ\text{C}, \frac{\Delta I_{io}}{\Delta T} = 10 \text{ nA}/^\circ\text{C}, V_s = \pm 15\text{V}$$

$$R_1 = 100 \Omega, R_F = 8.2 \text{ k}\Omega, R_L = 10 \text{ k}\Omega$$

Assume that the amplifier is nulled at 25 °C. If V_{in} is a 20mV peak sine wave at 100Hz:

- (a) Calculate E_v and V_o values at 45°C.
- (b) Draw the output voltage waveform at 25°C and 45°C.

OR

- (b) Design an input offset voltage compensating network for the inverting **07**
amplifier with $R_1 = 100\Omega$ and $R_F = 4.7 \text{ k}\Omega$. The op-amp is LM307 with $V_{io} = 10 \text{ mV}$ and supply voltages $\pm 10\text{V}$.

- Q.3** (a) Explain with necessary diagrams the working of Absolute value output **07**
circuit.
(b) Explain the following application of op-amp. **07**
(1) Small signal Half wave rectifier
(2) Peak Detector

OR

- Q.3** (a) Explain the application of op-amp as a positive and negative clipper **07**
circuit.
(b) Explain how op-amp can be used as a differentiator. Discuss the **07**
sources of error. Draw and explain practical differentiator circuit.

- Q.4** (a) Explain working of astable multivibrator using IC 555. Design the **07**
same for the output frequency of 10 kHz with a duty cycle of 25%.
(b) Draw and explain square wave generator using op-amp. **07**

OR

- Q.4 (a)** Using the LM 317, design an adjustable voltage regulator to satisfy the following specifications: output voltage $V_o = 10$ to 12V and $I_o = 200\text{ mA}$. For LM 317, $I_{\text{ADJ}} = 100\text{ }\mu\text{A}$. Draw the complete schematic diagram of the designed regulator. **07**
- (b)** Describe the working principle of phase-locked loop with basic blocks. Discuss its application as a frequency multiplier. **07**
- Q.5 (a)** Write short note on Sallen key circuit. **07**
- (b)** Design a Biquard bandpass filter with a center frequency of $\omega_o = 1000\text{ rad/s}$ and a bandwidth of 200 rad/s . The midband gain $H = 1$. **07**
- OR**
- Q.5 (a)** For the following set of Butterworth LPF specifications. **07**
 $\alpha_{\text{max}} = 0.5\text{ dB}$, $\alpha_{\text{min}} = 20\text{ dB}$,
 $W_p = 1000\text{ rad/sec}$, $W_s = 2000\text{ rad/sec}$
Determine :
(1) Order of Butterworth LPF
(2) Pole locations and corresponding Q_s
(3) Half Power frequency
- (b)** List the applications of Operational transconductance amplifier. Explain its application as a current controlled Integrator. **07**
