



## P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

**Fifth Semester, B.E. - Electrical and Electronics Engineering**

**Semester End Examination; Dec - 2016/Jan - 2017**

**Operational Amplifiers and Linear Integrated Circuits**

Time: 3 hrs

Max. Marks: 100

*Note: i) Answer FIVE full questions, selecting ONE full question from each unit.*

*ii) Use of resistor and capacitor standard values list and Op-amp data sheets are permitted.*

### UNIT - I

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|------|---|----|
| 1 a. | With a neat circuit diagram, design a high $Z_{in}$ capacitor coupled voltage follower. Obtain the expression for input impedance of the circuit.   | 10 |
|      | b. Design a capacitor coupled inverting amplifier to operate with a $\pm 20$ V supply. The minimum input signal level is 50 mV, the voltage gain is to be 68, the load resistance is $500 \Omega$ , the lowest cutoff frequency is to be 200 kHz. Use 741 Op-Amp ( $I_{Bmax} = 5000$ nA). | 8  |
|      | c. How do you set the upper cutoff frequency for an inverting amplifier?  | 2  |
| 2 a. | Explain the design of a capacitor coupled voltage follower and write the equations for finding circuit components.  | 8  |
|      | b. A capacitor coupled non-inverting amplifier is to have an $A_v = 90$ and $V_0 = 3$ V. The load resistance is $10 \text{ k}\Omega$ , and lower cutoff frequency is to be 70 Hz. Design a suitable circuit using 741 Op-Amp ( $I_{Bmax} = 500$ nA).                                      | 8  |
|      | c. Draw the circuit for a difference amplifier and write the equations for $X_{C1}$ , $X_{C2}$ and $X_{C3}$ .   | 4  |

### UNIT - II

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|------|---|---|
| 3 a. | What is frequency compensation? Mention the condition for system stability.   | 4 |
|      | b. Explain Miller effect compensation.  | 8 |
|      | c. Define slew rate and derive an expression for maximum/peak value of sine wave output voltage.                      | 8 |
| 4 a. | Discuss the method of compensating for stray capacitance with relevant circuit diagram and equations.                 | 6 |
|      | b. Discuss $Z_{in}$ Mod compensation technique of frequency compensation with relevant circuit diagram and equations. | 8 |
|      | c. List the precautions that should be observed for operational amplifier circuit stability.                          | 6 |

### UNIT - III

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|------|--|---|
| 5 a. | Sketch an Op-Amp precision full wave rectifier circuit. Draw its input and output waveforms. Explain the circuit operations. | 6 |
|      | b. Draw an Op-amp based sample and hold circuit. Draw its input, control and output waveforms. Explain circuit operations.   | 8 |

- c. Design a non saturating precision half wave rectifier to produce a 2 V peak output from a sign wave input with a peak value of 0.5 V and frequency of 1 MHz. Use a bipolar Op-Amp with a supply voltage of  $\pm 15$  V. 6
- 6 a. State the Bark Hausen criteria and explain how it is fulfilled in the RC phase shift oscillator? 8
- b. Draw the circuit of a Wein Bridge oscillator. Sketch the output and feedback voltage waveforms and explain the circuit operation. 6
- c. Using a BIFET Op-amp with a supply of  $\pm 12$  V, design a Wein Bridge oscillator to have an output frequency of 15 kHz. 6

#### UNIT - IV

- 7 a. Discuss the circuit operation and design of an Inverting Schmitt trigger circuit. Explain the means of adjusting the trigger points in such a circuit. 10
- b. Draw the circuit of an Op-Amp Mono-Stable Multi-Vibrator. Show the relevant voltage waveforms and explain its operation. 10
- 8 a. Draw the circuit of : 12
- i) First order, Low pass and first order, High pass filters
- ii) Second order, Low pass and second order High pass filters.
- b. Discuss the single stage first order band pass filters with relevant circuit diagrams and equations. 8

#### UNIT - V

- 9 a. Explain precision voltage regulator working with a neat diagram. 8
- b. Draw the relevant sketch and explain the operation of a universal active filter. 6
- c. Sketch the basic circuit of a 723 IC voltage regulator and explain. 6
- 10 a. Explain briefly the class A and class B power amplifier with neat circuit and wave forms. 10
- b. Briefly explain the operation of switched capacitor filter and mention the advantages of the same. 10

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