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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. - 2015

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) Missing data may suitably assume.
 iii) Use of resistor and capacitor standard values list and op-amp data sheets are permitted.

UNIT - I

- 1 a. Explain the working of a high input Impedance capacitor coupled voltage follower circuit, with a neat circuit diagram. 8
- b. Design a High Z_{in} capacitor – coupled non inverting amplifier to have a low cut off frequency of 200 Hz. The input and output voltages are to be 15 mV and 3 V respectively and the minimum load resistance is 12 k Ω . Design using a BIFET Op-amp. 8
- c. A capacitor coupled voltage follower is to be designed to have a lower cut-off frequency of 120 Hz. The load resistance is 8.2 k Ω and the op-amp used has a maximum input bias current of 600 nA. Design suitable circuit. 4
- 2 a. Sketch the circuit of a capacitor coupled inverting amplifier using a single polarity power supply. Briefly explain its operation. 6
- b. Design capacitor coupled inverting amplifier using op-amp 741, to have voltage gain of 100. Assume signal voltage of 10 mV and load of 4.7 k Ω and $f_L = 120$ Hz. 6
- c. Explain the upper cut off frequency of an op- amp circuit and derive the condition to set upper cut-off frequency for an Inverting amplifier. 8

UNIT - II

- 3 a. Define slew rate and derive an expression for maximum peak value of a sine wave O/P voltage. 6
- b. Discuss operational amplifier circuit stability and show how feedback in inverting amplifier can produce instability. 8
- c. Calculate the minimum rise time and maximum undistorted output pulse amplitude at that rise time for an amplifier with closed loop Gain 50, using a 741 op-amp. 6
- 4 a. Sketch the circuit of lag compensating network. Explain its operation. Show how it affects the frequency response of op-amp. 6
- b. List the precautions that should be observed for operational amplifier circuit stability. 6

- c. Explain the effects of : 8
 i) Stray capacitance ii) Load capacitance on circuit stability.

UNIT - III

- 5 a. Draw an op-amp sample and hold circuit sketch the signal, control and output voltage waveforms and explain the circuit operation. 12
 b. Using a BIFET op-amp, design a dead zone circuit to pass only the upper IV portion of the positive half cycle of a sine wave input with a 3 V peak value. Supply voltage is ± 15 V. 8
 6 a. Draw the circuit of a Triangular / Rectangular waveform generator which has frequency and duty cycle controls. Show all waveforms and explain the circuit operation. 10
 b. With a neat circuit diagram, explain the operation of precision pulse/minus clipping circuit using two dead zone circuits and show the wave forms at different points. 10

UNIT - IV

- 7 a. Draw the circuit of second order low and high pass filters and explain the circuit operation. 6
 b. Sketch the circuit of Monostable multivibrator. Draw the input and output waveforms and explain the circuit operation. 8
 c. Design a single stage band pass filter, to have unity voltage gain and a pass band from 300 Hz to 30 kHz. [Assume $C_2 = 1000$ pF]. 6
 8 a. What is a Band pass filter? Sketch the circuit of a single stage band pass filter, explain the low pass and high pass operation of circuit. Discuss the design. 8
 b. Using a 741 op-amp, design the first order active low-pass filter to have a 1.2 kHz cut-off frequency. [$V_i = 70$ mV], given. 6
 c. Design an Inverting Schmitt trigger circuit to give triggering points of ± 2 V. Using a 741 op-amp with $V_{cc} = \pm 12$ V. 6

UNIT - V

- 9 a. Write a short notes on : 12
 i) Universal active filter.
 ii) Switched capacitor filter.
 b. With a neat circuit diagram, explain the operation of a precision voltage regulator. 8
 10 a. What is phase - locked - loop? Explain it with a block diagram. 8
 b. Sketch the circuit of a voltage follower regulator and explain its operation. 6
 c. Explain the terms : 6
 Line Regulation, Load Regulation and Ripple Rejection for a d.c. Voltage Regulator.