U.S.N | | | | | | | | | | |

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

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; May/June - 2018

Operational Amplifier and Applications

Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1 a. Describe the following : 7

i) Input offset voltage ii) Input offset current iii) offset nulling

b. A 741 Op-amp is used in a non-inverting amplifier with a voltage gain of 50. Calculate the typical output voltage that would result from a common mode input with a peak level of 100 mV. 6

c. The circuit in Fig. Q1(c) uses a 741 Op-amp and has $R_1 = R_2 = 22\ k\Omega$ with a resistor tolerance of $\pm 20\%$. Determine the maximum input offset voltage due to, 7

i) The 741 specified input offset voltage

ii) The 741 input offset current

iii) The resistor tolerance

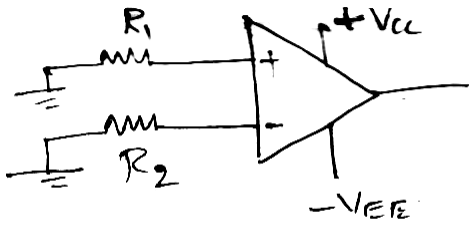

Fig Q1(c)

2 a. Design an inverting amplifier using a 741 Op-amp. The voltage gain is to be 50 and the output voltage amplitude is to be 2.5 V. 7

b. Design a capacitor-coupled voltage follower using a 741 Op-amp. The lower cut off frequency for the circuit is to be 50 Hz and the load resistance is $R_L = 3.9\ k\Omega$. 8

c. Describe capacitor coupled non-inverting amplifier. 5

UNIT - II

3 a. Using a LF353 BIFET Op-amp, 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 loads resistance is 12 kΩ. 12

b. Sketch the circuit of a capacitor-coupled non-inverting amplifier using a single-polarity supply. Explain. 8

4 a. Describe the following frequency compensation methods; 10

i) Phase-lag ii) Phase lead iii) Miller effect

Contd…2

b. Calculate the slew rate limited cutoff frequency for a voltage follower circuit using a 741 op-amp, if the peak of sine wave output is to be 5 V. Also determine the maximum peak value of the sinusoidal output voltage that will allow the 741 voltage follower circuit to operate at the 800 kHz unity-gain cutoff frequency. 6

c. List any four circuit stability precautions. 4

UNIT - III

5 a. Draw the circuit of a precision voltage source using an op-amp and a Zener diode. Explain the circuit operation and derive the equation relating V_0 and V_z. 10

b. Show how a half-wave precision rectifier can be combined with a summing circuit to produce a full wave precision rectifier. Draw the voltage wave forms throughout the circuit and write equations to show that full-wave rectification is performed. 10

6 a. A ±5v, 10 kHz square wave from a signal source with a resistance of 100 Ω is to have its positive peak clamped precisely at ground level. Tilt on the output is not to exceed 1% of the peak amplitude of the wave. Design a suitable op-amp circuit. Use a supply of ±12 V. 10

b. Sketch a precision rectifier peak detector circuit, draw the input and output wave forms and explain the circuit operation. Write the equation for calculating the capacitor value for a peak detector circuit. 10

UNIT - IV

7 a. Sketch the circuit of a triangular/rectangular wave form generator. Draw the output waveforms from the circuit showing their phase relationship and explain the circuit operation. 10

b. Using a 741 op-amp with a supply of ±12 V, design a phase shift oscillator to have an output frequency of 3.5 kHz. 10

8 a. Using a 741 op-amp with a supply of ±12 V, design a inverting Schmitt trigger circuit to have a trigger points of ±12 V. 10

b. Design a second-order high-phase active filter to have a cutoff frequency of 6 kHz. Use a 714 op-amp. 10

UNIT - V

9 a. Describe the operations of series op-amp voltage regulator. 8

b. Sketch the basic circuit of a 723 IC DC voltage regulator. Explain. 8

c. Define the following : 4

i) Line regulation ii) Load regulation

10 a. Draw the functional block diagram for a 555 IC timer. Identify all terminals and explain each component part. 10

b. Describe the operating principle of PLL. 6

c. Write a note on VCO. 4

* * * *