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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; March / April - 2022

Analog Electronic Circuits

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

*CO1 - **Apply** the knowledge of physics to describe the operation and characteristics of Op-Amps.*

*CO2 - **Discuss** the working of op-amp applications, signal generators, voltage regulators, ADC, DAC and PLL.*

*CO3 - **Analyze** the frequency response, stability and applications of op-amps.*

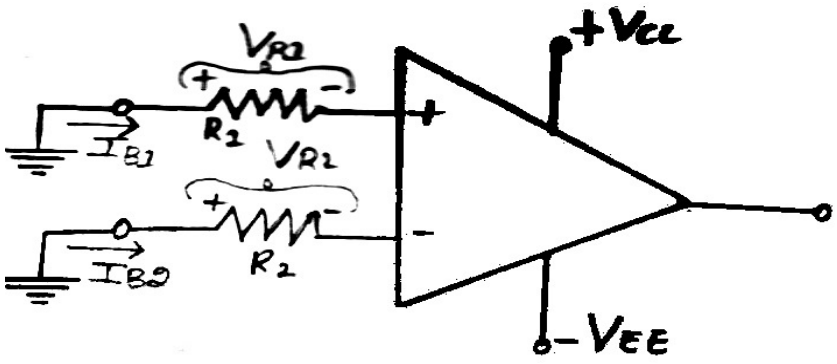
*CO4 - **Design** the different op-amp applications circuits, signal generators, voltage regulators, ADC, DAC for a given specifications.*

*CO5 - **Work** as individual or in groups to model different op-amp circuits using simulation tools.*

***Note:** **I) PART - A** is compulsory. **Two** marks for each question.*

***II) PART - B**: Answer any **Two** sub questions (from a, b, c) for Maximum of **18 marks** from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	Define CMRR.	2	L1	CO1	PO1
b.	Draw the circuit diagram of inverting Schmitt trigger.	2	L1	CO1	PO1
c.	Draw the circuit diagram of diode-capacitor peak detector.	2	L1	CO2	PO1
d.	Draw the circuit diagram of first order law pass filter.	2	L1	CO3	PO1
e.	Write the expression for output voltage for 5- bit R-2R DAC.	2	L3	CO4	PO2
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	The circuit comprising 741 op-amp has $R_1 = R_2 = 22$ kΩ with a resistor tolerance of ± 20%. Determine the maximum input effect voltage due to, i) The 741 specified input offset voltage ii) The 741 input offset current iii) The resistor tolerance From the datasheet: $V_{i(offset)} = 5$ mV maximum; $I_{i(offset)} = 200$ nA maximum	9	L3	CO1	PO3



b.	Using a 741 op-amp design a non-inverting amplifier to have a voltage gain of approximately 50. The signal amplitude is 15 mV. For 741 $I_{B(max)} = 500$ nA. Draw the circuit diagram.	9	L3	CO1	PO3

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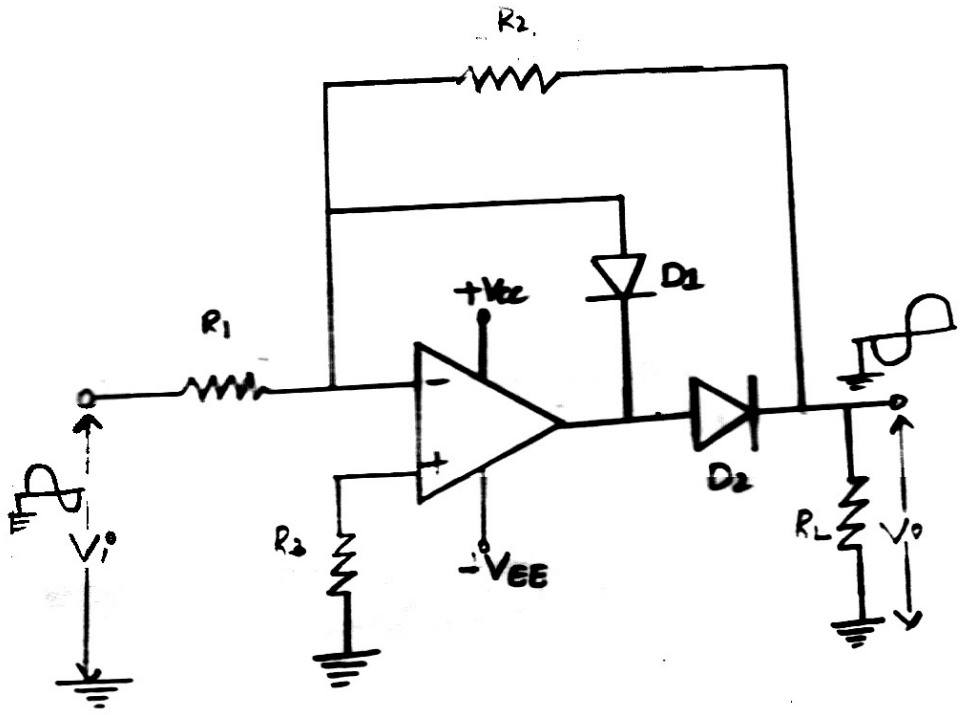
c.	Design a capacitor coupled voltage follower using 741 operational amplifier. The lower cutoff frequency for the circuit is to be 50 Hz, and the load resistance R_L = 5.6 kΩ, $I_{B(max)}$ = 500 nA. Draw the circuit.	9	L3	CO1	PO3

UNIT - II **18**

2 a.	i) 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. ii) Determine the maximum peak value of the output amplitude for the 741 voltage follower circuit to operate at the 800 kHz unity gain cutoff frequency. iii) Calculate the maximum peak value of sine wave output voltage that can be produced by the amplifier with 8 kHz cut-off frequency.	9	L2	CO2	PO2
b.	State and explain the circuit stability precaution.	9	L2	CO2	PO2
c.	With neat circuit diagram and relevant waveforms explain the working of op-amp based inverting Schmitt trigger circuit.	9	L2	CO3	PO2

UNIT - III **18**

3 a.	Design a non-saturating precision half wave rectifier as in figure to produce a 2 V peak output from a sine 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 ± 12 V, I_I = 500 μA.	9	L3	CO3	PO3



b.	With neat diagram, explain the working of voltage follower peak detector	9	L2	CO2	PO2
c.	With neat diagram, explain the working of 555 monostable multivibrator.	9	L2	CO3	PO2

Contd... 3

UNIT - IV **18**

4 a.	With neat circuit diagram, explain the working of triangular / rectangular wave generator.	9	L2	CO4	PO2
b.	Draw the circuit diagram of second order low pass filter. Design the circuit to have a cutoff frequency of 1 kHz. Use Op-amp 741. $I_{B(max)}$ for op-amp 741 is 500 nA.	9	L3	CO3	PO3
c.	Draw the circuit diagram of voltage regulator with a current limiting circuit. Illustrate how the circuit can be used for short circuit protection with the help of characteristic curve of current limiting circuit.	9	L2	CO2	PO2

UNIT - V **18**

5 a.	With neat diagram, explain the working of digital RAMP ADC. Draw the relevant waveform.	9	L2	CO2	PO1
b.	Explain the operation of 3-bit R-2R ladder D/A converter. Write the expression for output voltage. Show the magnitude and direction of current with R_1 = 10 kΩ and R_2 = 5 kΩ.	9	L2	CO4	PO2
c.	Explain the operation of PLL system with neat block diagram and relevant waveform.	9	L2	CO4	PO1

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