

III B. Tech I Semester Regular/Supplementary Examinations, October/November- 2016
LINEAR & DIGITAL IC APPLICATIONS
 (Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. Answering the question in **Part-A** is compulsory
 3. Answer any **THREE** Questions from **Part-B**

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**PART -A**

- 1 a) What is a current mirror and why is it called so? [4M]
- b) One differential amplifier has CMRR of 200dB and another has CMRR of 50dB. [4M]  
Which you will prefer and why?
- c) What is Zero crossing detector? [3M]
- d) List application of 555 timer. [4M]
- e) Design a second order Butterworth low pass filter having upper cut off frequency of [4M]  
2KHz.
- f) List the various ADC techniques. [3M]

**PART -B**

- 2 a) What are the non ideal DC characteristics of an op-amp? [8M]
- b) List the ac characteristics of an op amp? Explain the procedure for measuring slew rate. [8M]
- 3 a) Define the following electrical parameters: input offset voltage, input resistance, [8M]  
CMRR, output voltage swing and slew rate.
- b) The 741C is connected as a non inverting amplifier for a gain of 100. Determine the [8M]  
stability of the amplifier at this gain.
- 4 a) Discuss the basic requirements of an instrumentation amplifier. [5M]
- b) Explain about the working on instrumentation amplifier. [8M]
- c) Draw a system whose gain is controlled by an adjustable resistance. [3M]
- 5 a) Define capture range, lock in range and pull in time of PLL. [8M]
- b) Why is capture range always smaller than the lock in range? [8M]
- 6 a) Draw the characteristic of a first order active notch filter. [8M]
- b) Define Butterworth and Chebyshev filter and compare their responses. [8M]
- 7 a) How many comparators are required to build an n bit flash type A/D converter? [8M]
- b) Explain a R-2R Ladder type D/A converter. [8M]

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**PART -A**

- 1 a) Design an amplifier with a gain of +5 using one op-amp. [4M]
- b) A 100PF capacitor amplifier has a maximum charging current of 150 $\mu$ A. What is its slew rate? [4M]
- c) What is a precision rectifier? [4M]
- d) Design a first order low pass filter at a frequency of frequency of 2KHz with a pass band gain of 2. [4M]
- e) List the applications Mono stable multi vibrator. [3M]
- f) Find the digital output, for a dual slope integrating ADC whose  $V_{in}=100\text{mv}$  [3M]

**PART -B**

- 2 a) Draw the internal circuit diagram of IC 741 operational amplifier and explain the function of each stage. [8M]
- b) List out various configurations of a Differential amplifier. [8M]
- 3 a) The base current in a differential amplifier is 22mA and 26mA .What is the value of input offset current and input bias current? [8M]
- b) Explain about open loop configuration of op-amp. Why closed loop configuration is preferred over open loop configuration? [8M]
- 4 a) Explain the difference between the integrator and differentiator and give one application of each. [8M]
- b) Draw and explain the operation of a current to voltage converter. If 741 IC is used, what is the lowest valve of current that may be measured? [8M]
- 5 a) Derive the expression for free running frequency of VCO. [8M]
- b) What is VCO? Explain the operation of grounded capacity types of VCO. [8M]
- 6 a) Why are active filters preferred? List the commonly used filters. [8M]
- b) Define a Notch filter. How do we get a notch filter from a band pass filter? [8M]
- 7 a) Define the terms 'Resolution', 'Linearity', 'Accuracy', 'Conversion time' and 'settling time' of an analog to digital converter? [8M]
- b) Calculate the conversion time for a full scale input in case of a 12-bit counter type analog to digital converter driven by 2MHZ clock?. [8M]

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**PART -A**

- 1 a) Design a non-inverting amplifier with a gain of 10. [4M]
- b) An op-amp has a slew rate of  $2V/\mu\text{sec}$ . If the peak output is 15V. What is the power and bandwidth. [4M]
- c) List different types of comparator circuits. [4M]
- d) List the applications of PLL. [4M]
- e) A first order low pass Butterworth active filter has a cut-off frequency of 10KHz and unity gain at low frequency. Find the voltage transfer function magnitude in dB, at 12 KHz for the filter. [3M]
- f) Where do we use successive approximating type ADC? [3M]

**PART -B**

- 2 a) What is an op-amp? Explain the characteristics of an ideal op-amp. [8M]
- b) Explain with figures how two supply voltages  $V^+$  and  $V^-$  are obtained from a single supply [8M]
- 3 a) A Differential amplifier has (i)  $CMRR=1000$  and (ii)  $CMRR=10,000$ . The first set of inputs are  $V_1 = +200\mu\text{V}$  and  $V_2 = -200\mu\text{V}$ . The Second set of input are  $V_1= 1200\mu\text{V}$  and  $V_2= 800\mu\text{V}$ . Compare the levels of output voltages obtained for the two sets of input voltages and comment on the performance of differential amplifier based on the results. [8M]
- b) Explain about closed loop configuration of op-amp. Why it is preferred over open loop configuration? [8M]
- 4 a) Draw the circuit diagram and explain the operation of the Schmitt trigger. [8M]
- b) Design a Schmitt trigger for  $UTP = 0.5V$  and  $LTP = -0.5V$ . (Assume the data if necessary) [8M]
- 5 a) Briefly explain the use of PLL for FM detection. [8M]
- b) Using neat sketches, explain how a PLL can be used as frequency translator. [8M]
- 6 a) What is pass band and stop band for a filter with respect to its response? Compare the different classes of filters. [8M]
- b) Design and explain the operation of Band pass filter. [8M]
- 7 a) Using an op-amp draw the functional diagram of successive approximation ADC and explain its working. [8M]
- b) Explain the working of a dual slope A/D converter. [8M]

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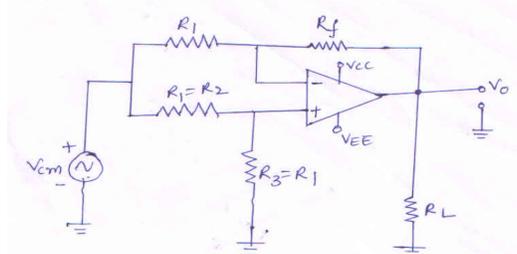
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**PART -A**

- 1 a) Design an inverting amplifier with a gain of -5 and an input resistance of 10KΩ. [4M]
- b) A square wave of peak to peak amplitude of 500mV has to be amplified to peak to peak amplitude of 3 volts, with a rise time of 4 μs or less. Can be 741 be used? [4M]
- c) Design an adder circuit using an op-amp to get the output expression as  $V_0 = -(0.1V_1 + V_2 + 10V_3)$  where  $V_1, V_2$  and  $V_3$  are the inputs. [4M]
- d) Write the function diagram of 8 pin DIP. [4M]
- e) List the advantages of active filters over passive filters. [3M]
- f) Mention the types of DAC's. [3M]

**PART -B**

- 2 a) Explain about FET differential amplifier. [8M]
- b) Why are FET op-amps better than BJT op-amps? [5M]
- c) What is the input impedance of a non-inverting op-amp? [3M]
- 3 a) Draw the pin diagram and schematic symbol of a typical op-amp IC 741 and explain the function of each pin. [8M]
- b) In the circuit of figure given below,  $R_1 = 100\Omega, R_f = 4.7\text{ k}\Omega, \text{CMRR} = 90\text{dB}$ . If the amplitude of the induced 60-Hz noise at the output is 5 mV(r.m.s), Calculate the amplitude of the common mode input voltage  $V_{cm}$  [8M]



- 4 a) Draw the circuit of full wave rectifier and explain how it gives the average values. [8M]
- b) Draw a half wave rectifier circuit and explain its operation. [8M]
- 5 a) What is timer IC 555? Draw the internal structure of IC 555 timer and explain it. [8M]
- b) Design a stable multi vibrator using 555 timer for a frequency of 1KHz and a duty cycle of 70%. Assume  $C = 0.1\ \mu\text{F}$ . [8M]
- 6 a) What is meant by Butterworth response? What are the Characteristics of Butterworth filters? [8M]
- b) Design a narrow band, band pass filter using an op-amp. The resonant frequency is 100Hz and  $Q = 2$ . Assume  $C = 0.1\ \mu\text{F}$ . [8M]
- 7 a) Explain the working of a counter type A/D converter and state its important features. [8M]
- b) Briefly explain the working of weighted resistor D/A converter. [8M]

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