*Total No. of Questions: 6* *Total No. of Printed Pages:3*

**Enrollment No.....**

# Faculty of Engineering

## End Sem (Even) Examination May-2019

## EC3CO02 / EC3CO17 / EI3CO02 / EI3CO17

## Linear Integrated Circuit & Applications

Programme: B.Tech. Branch/Specialisation: EC/EI

**Duration: 3 Hrs.** **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The active components in an IC are _____ **1**

(a) Resistors (b) Capacitors (c) Transistors (d) None of these

ii. Define the common-mode rejection ratio (CMRR) of op-amp? **1**

(a) CMRR=$A_D/A_{CM}$ (b) CMRR=$A_{CM}/A_D$

(c) CMRR=$V_{OCM}/A_{CM}$ (d) CMRR=$A_D*A_{CM}$

iii. The purpose of level shifter in Op-amp internal circuit is to **1**

(a) Adjust DC voltage (b) Increase impedance

(c) Provide high gain (d) Decrease input resistance

iv. Why clamp diodes are used in comparator? **1**

(a) To reduce output offset voltage

(b) To increase gain of op-amp

(c) To reduce input offset current

(d) To protect op-amp from damage

v. A narrow band-reject filter is commonly called as **1**

(a) Notch filter (b) Band step filter

(c) Delay filter (d) All of these

vi. Why inductors are not preferred for audio frequency? **1**

(a) Large and heavy (b) High cost

(c) High input impedance (d) None of these

vii. What does the discharge transistor do in the 555 timer circuit? **1**

(a) Charge the external capacitor to stop the timing

(b) Charge the external capacitor to start the timing over again

(c) Discharge the external capacitor to stop the timing

(d) Discharge the external capacitor to start the timing over again

P.T.O.

viii. An Astable multivibrator requires: **1**
(a) Balanced time constants (b) A pair of matched transistors
(c) No input signal (d) Dual J-K flip-flops

ix. Calculate the voltage regulation of a power supply having $V_{NL}$ = 50 V and $V_{FL}$ = 48 V **1**
(a) 4.17% (b) 5.2% (c) 6.2% (d) 7.1%

x. What is the purpose of an additional RC filter section in a power supply circuit? **1**
(a) Decrease the dc voltage component
(b) Increase the ac voltage component
(c) Decrease the ac voltage component
(d) None of these

Q.2 i. Draw equivalent circuits of a practical OP-AMP. **2**
ii. Write down any six characteristics of ideal OP-AMP. **3**
iii. Draw the circuit of Dual Input unbalanced Output differential amplifier and find the ac voltage gain, input impedance of this circuit. **5**
OR iv. Explain the following for OP-AMP input offset voltage, offset current, input bias current, CMRR and slew rate. **5**

Q.3 i. Draw the circuit of summing amplifier and derive expression for its output voltage. **2**
ii. Draw the circuit diagram of integrator and differentiator and derive expression for output voltage. **3**
iii. What is an instrumentation amplifier? Draw the circuit diagram and derive the expression of output voltage for an instrumentation amplifier. **5**
OR iv Explain the triangular wave generator and comparator circuit. Also draw the neat and clean output wave forms. **5**

Q.4 i. Write down any four differences between active and passive filters. **2**
ii. Draw the circuit diagram of notch and band pass filter. **3**
iii. Draw the first order low pass and high pass filter circuit and derive the expression for their voltage gain. **5**
OR iv. Draw the circuit diagram of All pass filter and derive the expression of voltage gain. Design an all pass filter which generate phase shift of $90^o$ at 1KHz frequency. **5**



Q.5 i. Write down any four differences between clipper and clamper. **2**
ii. Draw and explain the working of Sample and hold circuit. **3**
iii. Draw the circuit diagram of monostable multivibrator using 555 timer and explain its working with suitable waveforms. **5**
OR iv. Draw the circuit diagram of Astable multivibrator using 555 timer and explain its working with suitable waveforms. **5**

Q.6 i. Explain the load and line regulation. **2**
ii. Draw the circuit of basic Switching Regulator and explain its working. **3**
iii. Draw the circuit of Op-Amp based series and shunt voltage regulator circuit and explain its working principal. **5**
OR iv. Draw the circuit diagram of Switch Mode Power Supply (SMPS) and explain it. **5**

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# Marking Scheme
## EC3CO02 / EC3CO17 / EI3CO02 / EI3CO17
## Linear Integrated Circuit & Applications

| | | | | |
|---|---|---|---|---|
| Q.1 | i. | The active components in an IC are _____<br>(c) Transistors | | **1** |
| | ii. | Define the common-mode rejection ratio (CMRR) of op-amp?<br>(a) CMRR=$A_D/A_{CM}$ | | **1** |
| | iii. | The purpose of level shifter in Op-amp internal circuit is to<br>(a) Adjust DC voltage | | **1** |
| | iv. | Why clamp diodes are used in comparator?<br>(d) To protect op-amp from damage | | **1** |
| | v. | A narrow band-reject filter is commonly called as<br>(a) Notch filter | | **1** |
| | vi. | Why inductors are not preferred for audio frequency?<br>(a) Large and heavy | | **1** |
| | vii. | What does the discharge transistor do in the 555 timer circuit?<br>(d) Discharge the external capacitor to start the timing over again | | **1** |
| | viii. | An Astable multivibrator requires:<br>(c) No input signal | | **1** |
| | ix. | Calculate the voltage regulation of a power supply having $V_{NL}$ = 50 V and $V_{FL}$ = 48 V<br>(a) 4.17% | | **1** |
| | x. | What is the purpose of an additional RC filter section in a power supply circuit?<br>(c) Decrease the ac voltage component | | **1** |
| Q.2 | i. | Equivalent circuits of a practical OP-AMP. | | **2** |
| | ii. | Any six characteristics of ideal OP-AMP. | | **3** |
| | | 0.5 mark for each | (0.5 mark * 6) | |
| | iii. | Circuit of Dual Input unbalanced Output | 1 mark | **5** |
| | | ac voltage gain | 2 marks | |
| | | Input impedance of this circuit. | 1 mark | |
| | | Ac equivalent circuit | 1 mark | |
| OR | iv. | OP-AMP input offset voltage | 1 mark | **5** |
| | | Offset current | 1 mark | |
| | | Input bias current | 1 mark | |
| | | CMRR | 1 mark | |
| | | Slew rate | 1 mark | |

| | | | | |
|---|---|---|---|---|
| Q.3 | i. | Circuit of summing amplifier | 1 mark | **2** |
| | | Expression for its output voltage | 1 mark | |
| | ii. | Circuit diagram of integrator | | **3** |
| | | Diagram | 0.5 mark | |
| | | Derivation | 1 mark | |
| | | Differentiator | | |
| | | Diagram | 0.5 mark | |
| | | Derivation | 1 mark | |
| | iii. | Instrumentation amplifier | 1 mark | **5** |
| | | Circuit diagram | 1 mark | |
| | | Output voltage for an instrumentation amplifier. | 3 marks | |
| OR | iv | Triangular wave generator circuit | 1 mark | **5** |
| | | Explanation | 1 mark | |
| | | Output wave forms | 0.5 mark | |
| | | Comparator circuit | 1 mark | |
| | | Explanation | 1 mark | |
| | | Output wave forms | 0.5 mark | |
| Q.4 | i. | Any four differences between active and passive filters | | **2** |
| | | 0.5 mark for each difference | (0.5 mark * 4) | |
| | ii. | Circuit diagram of notch | 1.5 marks | **3** |
| | | Circuit diagram of band pass filter | 1.5 marks | |
| | iii. | First order low pass | | **5** |
| | | Diagram | 1 mark | |
| | | Derivation | 1.5 marks | |
| | | High pass filter circuit | | |
| | | Diagram | 1 mark | |
| | | Derivation | 1.5 marks | |
| OR | iv. | Circuit diagram of All pass filter | 1 mark | **5** |
| | | Expression of voltage gain | 2 marks | |
| | | Design of $90^o$ phase shift circuit | 2 marks | |
| Q.5 | i. | Any four differences between clipper and clamper | | **2** |
| | | 0.5 mark for each difference | (0.5 mark * 4) | |
| | ii. | Diagram of Sample and hold circuit. | 1 mark | **3** |
| | | Working of Sample and hold circuit. | 2 marks | |
| | iii. | Circuit diagram of monostable multivibrator using 555 timer | | **5** |

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|---|---|---|---|---|
| | | | 1 mark | |
| | | Its working | 3 marks | |
| | | Suitable waveforms | 1 mark | |
| OR | iv. | Circuit diagram of Astable multivibrator using 555 timer | | **5** |
| | | | 1 mark | |
| | | Its working | 3 marks | |
| | | Suitable waveforms | 1 mark | |
| Q.6 | i. | Load regulation | 1 mark | **2** |
| | | Line regulation | 1 mark | |
| | ii. | Circuit of basic Switching Regulator | 1 mark | **3** |
| | | Its working. | 2 marks | |
| | iii. | Circuit of Op-Amp based series regulator | | **5** |
| | | Circuit | 1 mark | |
| | | Explanation | 1.5 mark | |
| | | Circuit of Op-Amp based shunt voltage regulator | | |
| | | Circuit | 1 mark | |
| | | Explanation | 1.5 marks | |
| OR | iv. | Circuit diagram of Switch Mode Power Supply (SMPS) | | **5** |
| | | | 2 marks | |
| | | Its working | 3 marks | |

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