MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University) Rasipuram - 637 408, Namakkal Dist., Tamil Nadu

EEE

Must Know Concepts (MKC)

MKC

2021-2022

Course Code & Course Name : 19EEC03 & Linear Integrated Circuits

Year/Sem : II/III

S.No	Term	Notation (Symbol)	Concept/Definition/Meaning/Units/Equation/ Expression	Units
			UNIT-I CHARACTERISTICS OF OPAMP	
1	Integrated Circuit (IC)	-	An integrated circuit (IC) is a small semiconductor-based electronic device consisting of fabricated transistors, resistors and capacitors.	-
2	Linear Integrated Circuits	-	An analog IC is said to be Linear, if there exists a linear relation between its voltage and current.	-
3	Digital Integrated Circuits	-	Digital Integrated Circuits handle discrete signals such as binary values (0 and 1).	-
4	Generation of IC	-	1. SSI 2. LSI 3. MSI 4. VLSI 5. ULSI 6. SOC 7. WSI	-
5	Classifications of IC	-	Based on the mode of operation, IC's are of 2 types 1. Linear IC (Analog IC) 2. Digital IC. Based on the fabrication, IC's are of 2 types 1. Monolithic IC 2. Hybrid IC	-
6	Inverting Amplifier	-	An inverting amplifier not only amplifies the input but also inverts it (changes its sign).	-
7	Application of inverting amplifier	-	Current amplifier and buffers, Transimpedance amplifier, Differential Amplifier Circuit Tutorial using BJT and Opamp, Voltage comparator and Summing amplifier	-
8	Application of non-linear op- amp	-	1. Industrial instrumentation 2. Communication 3. Signal processing	-
9	Applications of linear op – amps	-	Adder, subtractor, voltage –to- current converter, current –to-voltage converters, instrumentation amplifier, analog computation, power amplifier	-
10	Gain of inverting amplifier		The ratio of the output voltage V0and the input voltage Vi is the voltage-gain or gain of the amplifier.	-

		$\frac{V_0}{V_i} = \frac{-R_f}{R_1}$		
11	Non-Inverting Amplifier	-	A non-inverting amplifier amplifies the input, without inverting or changing the sign of the output.	-
12	Gain of the non-inverting amplifier	$\frac{V_0}{V_i} = 1 + \frac{R_f}{R_1}$	The voltage-gain or gain of the non-inverting amplifier is equal $1+R_f/R_1$.	-
13	Characteristics of an ideal OP-Amp.	-	1. Infinite voltage gain 2. Infinite input impedance 3. Zero output impedance 4. Infinite bandwidth 5. Zero input offset voltage	-
14	Parameters of an op amp	-	1. Voltage gain 2. Input impedance 3. Output impedance 4. Input offset current 5. Input bias current 6.Bandwidth	-
15	Op-amp	-	Special type of amplifier ,by proper selection of its external components could be configured for a variety of operations.	-
16	Input impedance	z_i	The resistance offered by the input of an op amp is called input impedance.	-
17	Voltage gain	A_v	Output voltage/Input voltage	-
18	Input offset voltage	-	To force the output voltage to zero we need to apply some dc voltage	-
19	Input offset current	-	The difference between the currents in to the two input terminals when the output is held at zero is called input offset current,	-
20	Input bias current	-	The input bias current parameter, I_{IB}, is defined as the average of the currents into the two input terminals with the output at a specified level. It is expressed in units of amperes. CMOS and JFET inputs offer much lower input current than standard bipolar inputs.	-
21	DC Characteristics of an Op-Amp	-	Input bias current. Input offset current. Input offset voltage. Thermal drift.	-
22	Frequency response	-	Frequency response is the quantitative measure of the output spectrum of a system or device in response to a stimulus, and is used to characterize the dynamics of the system. It is a measure of magnitude and phase of the output as a function of frequency, in comparison to the input.	
23	Circuit Stability	-	Due to the feedback network, high-frequency oscillations can occur in many operational amplifier circuits, and when this happens the circuit is termed unstable. Measures taken to combat Operational Amplifier Circuit Stability are referred to as frequency compensation.	-
24	Slew rate	-	Slew rate is defined as the maximum rate of change of an op amps output voltage, and is given in units of volts per microsecond. Slew rate is measured by applying a large signal step, such as one volt, to the input of the op amp, and measuring the rate of change from 10% to 90% of the output	V/ms

			signal's amplitude.	
25	Compensation	-	Internally compensated op amps are not unconditionally stable. They are multiple pole systems, but they are internally compensated such that they appear as a single pole system over much of the frequency range	-
UNIT-II APPLICATIONS OF OPERATIONAL AMPLIFIER				
26	AC Amplifier	-	To amplify a small AC input signal, such as an audio or radio frequency signal. A small AC voltage is applied to the input, through a coupling capacitor.	-
27	Differential amplifier	-	A differential amplifier amplifies the voltage difference applied to two inputs.	-
28	Configurations of differential amplifier	-	Dual input, balanced output differential amplifier. Dual input, unbalanced output differential amplifier. Single input balanced output differential amplifier. Single input unbalanced output differential amplifier.	-
29	Common Mode Voltage	A_{CM}	Common-mode voltage gain refers to the amplification given to signals that appear on both inputs relative to the common.	-
30	Differential mode gain	A_{DM}	The ratio of the output voltage of a differential amplifier to the differential-mode input voltage.	-
31	Improve CMRR	-	To increase CMRR, emitter resistance RE should be increased. Higher the value of RE , more is the negative feedback and less is the common mode gain. Thus with the increase in RE , common mode voltage gain decreases and CMRR increases.	-
32	Hybrid parameters	hie,hoe,hfe, hre	Hybrid parameters (also known as h parameters) are known as 'hybrid' parameters as they use Z parameters, Y parameters, voltage ratio, and current ratios to represent the relationship between voltage and current in a two port network	-
33	Voltage follower	-	A voltage follower is an electronic circuit, which produces an output that follows the input voltage.	-
34	Gain of a voltage follower	$\frac{V_0}{V_i} = 1$	The gain of a voltage follower is equal to one since, both output voltage V_0 and input voltage Vi of voltage follower are same.	-
35	Adder	-	It produces an output equal to the sum of the input voltages applied at its inverting terminal.	-
36	Subtractor	-	It produces an output equal to the difference of the input voltages applied at its inverting and non-inverting terminals.	-
37	Differentiator	-	It produces an output, which is equal to the differential of input voltage that is applied to its inverting terminal.	-
38	Integrator	-	It produces an output, which is an integral of the input voltage applied to its inverting terminal.	-
39	Virtual ground	-	In op amps the term virtual ground means that the voltage at that particular node is almost equal to ground voltage (0V). It is not physically connected to ground.	-
40	Current mirror	-	The circuit in which the output current is forced to equal the input current is called current mirror.	-
41	clipper	-	a clipper is a circuit designed to prevent a signal from exceeding a predetermined reference voltage level.	
42	clamper	-	A clamper is an electronic circuit that fixes either the positive or the negative peak excursions of a signal to a defined value	-

			by shifting its DC value.	
43	Applications of Clipper	-	Used in multiple devices such as receivers, amplitude selectors, and transmitters	-
44	Applications of Clampper	-	Employed in sonar and radar systems	-
45	Common Mode Rejection Ratio	ρ = Adm/Acm	It is the ratio of the closed loop differential gain, Ad and the common mode gain, Ac	-
46	Positive Clipper	-	A Clipper circuit in which the diode is connected in series to the input signal and that attenuates the positive portions of the waveform, is termed as Positive Series Clipper.	-
47	Negative Clipper	-	A Clipper circuit in which the diode is connected in series to the input signal and that attenuates the negative portions of the waveform, is termed as Positive Series Clipper.	-
48	Filter	-	a filter is a device or process that removes some unwanted components or features from a signal.	-
49	Active Low Pass Filter	-	It allows (passes) only low frequency components and rejects (blocks) all other high frequency components	-
50	Active High Pass Filter	-	It allows (passes) only high frequency components and rejects (blocks) all other low frequency components	-
UNIT III: WAVEFORM GENERATOR				
51	RC Phase Shift Oscillator	-	It produces a sinusoidal voltage signal at the output with the help of an inverting amplifier and a feedback network	-
52	Wien Bridge Oscillator	-	It produces a sinusoidal voltage signal at the output with the help of a non-inverting amplifier and a feedback network	-
53	Square Wave Generator	-	A square wave generator is an electronic circuit which generates square wave.	-
54	Triangular wave generator	-	It is an electronic circuit, which generates a triangular wave..	-
55	Oscillator	-	oscillator is a circuit which produces a continuous, repeated, alternating waveform without any input.	-
56	Types of Oscillator	-	1.RC Phase Shift Oscillator 2.Wien Bridge Oscillator 3.Crystal Oscillator. 4.Hartley oscillator. 5.Colpitts Oscillators	-
57	Applications of RC Phase Shift Oscillator	-	Used in musical instruments, GPS units, & voice synthesis.	-
58	Applications of Wien bridge Shift Oscillator	-	1.These are highly used for audio testing. 2.Clock signals for testing filter circuits can be generated by this oscillator. 3.Used in distortion testing of power amplifiers. 4.These are also used as excitation for the AC bridges.	-
59	Hartley oscillator		An electronic oscillator circuit in which the oscillation frequency is determined by a tuned circuit consisting of capacitors and inductors, that is, an LC oscillator.	-
60	Schmitt trigger	-	It is used to convert a slowly changing input waveform into an output waveform with sharp transitions.	-
61	Colpitts Oscillator	-	A Colpitts Oscillator is a type of LC oscillator. The Colpitts is made of two capacitors in series across the inductor.	-
62	Multivibrators	-	It is used extensively in timing applications. It is a wave shaping circuit which gives symmetric or asymmetric square -	-

			output.	
63	Monostable Multivibrator	-	It generates a single pulse of specified duration in response to each external trigger signal. It has only one stable state.	-
64	Astable Multivibrator	-	It has two quasi-stable states. It oscillations between these two states and no external signal is required to produce the change in state.	-
65	Applications of Hartley oscillator	-	1.The Hartley oscillator is to produce a sine wave with the desired frequency. 2.Hartley oscillators are mainly used as radio receivers. 3.The Hartley oscillator is Suitable for oscillations in RF (Radio-Frequency) range, up to 30MHZ.	-
66	Applications of Colpitts oscillator	-	1.Colpitts oscillators are used for high frequency range and high frequency stability 2.A surface acoustical wave (SAW) resonator 3.Microwave applications 4.Mobile and communication systems	-
67	Peak detector	-	A peak detector is a series connection of a diode and a capacitor outputting a DC voltage equal to the peak value of the applied AC signal.	-
68	crystal oscillator	-	A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a constant frequency	-
69	Applications of crystal oscillator	-	computers, digital systems, instrumentation, phase locked loop systems, marine, modems, sensors, telecommunications, disk drives	-
70	Window Detector	-	Op-amp window comparators are a type of voltage comparator circuit which uses two op-amp comparators to produce a two-state output that indicates whether or not the input voltage is within a particular range or window of values by using two reference voltages.	-
71	Applications of Window Detector	-	To monitor the battery voltage lying within the desired range, in industrial alarms, in level detectors and controls, in digital computers,	-
72	Sawtooth waveform	-	Sawtooth waveform is used in pulse width modulation circuits and time-base generators.	-
73	Frequency of RC Phase Shift Oscillator	-	$Fr = 1/2\pi RC\sqrt{2N}$	-
74	Frequency of Wien bridge Oscillator	-	$Fr = 1/2\pi RC$	-
75	Frequency of Hartley Oscillator	-	$Fr = 1/2\pi\sqrt{LC}$	-
UNIT IV- D/A & A/D CONVERTORS AND PHASE LOCKED LOOP				
76	Linear voltage regulator	-	It is used to maintain a steady voltage. The resistance of the regulator varies in accordance with the load resulting in a constant voltage output.	-
77	Capture range of PLL	-	The range of frequencies over which the PLL can acquire lock with an input signal is called the capture range.	-
78	Voltage controlled oscillator	-	It is a free running multivibrator operating at a set frequency	-

79	Lock range of PLL	-	The range of frequencies over which the PLL can maintain lock with the incoming signal	-
80	Capture range of PLL	-	The range of frequencies over which the PLL can acquire lock with an input signal.	-
81	PLL Applications	-	• Frequency multiplication/division • Frequency translation • AM detection •FM demodulation • FSK demodulation.	-
82	Building blocks of PLL	-	1.Phase detector/comparator 2.Low pass filter 3.Error amplifier 4.Voltage controlled oscillator	-
83	Voltage-controlled oscillator	-	A voltage-controlled oscillator is an electronic oscillator whose oscillation frequency is controlled by a voltage input	-
84	Applications of Voltage-controlled oscillator	-	1. Electronic jamming equipment. 2. Function generator. 3. Production of electronic music, 4. Phase locked loop. 5. Frequency synthesizers, used in communication	-
85	Application of integrating type converter	-	1.Digital meter 2.Panel metre 3.monitoring system where the conversion accuracy is critical.	-
86	Specification in ADC/DAC	-	1.Resolution 2.Linearity 3,Accuracy 4.Settling time 5.Stability	-
87	Resolution	-	Smallest change in voltage which may be produced at the output(or input) of the converter.	-
88	Relative accuracy	-	Maximum deviation after gain and offset errors have been removed.	-
89	Settling time	-	Time takes for the output to settle within a specified band LSB of its final value following a code change at the input.	-
90	Components in the feedback of PLL	-	1.Phase detector 2.An error amplifier 3.A voltage controlled oscillator	-
91	Lock in range	-	The range of frequencies over which the PLL can maintain lock with the incoming signal.	-
92	Capture range in PLL	-	The range of frequencies over which the PLL can acquire lock with an input signal is called the capture range.	-
93	Pull in time	-	The total time taken by the PLL to establish lock is called Pull in time.	-
94	Frequency shift keying demodulator	-	Binary data is transmitted by means of a carrier frequency which is shifted between two preset frequencies.	-
95	Analog multiplier	-	A multiplier produces an output v_0, which is proportional to the product of two inputs v_x and v_y	-
96	Opto-Coupler	-	Opto-Coupler Ic Is A Combined Package Of A Photo-Emitting Device And A Photo sensing Device.	-
97	Power amplifier	-	It deliver large power to the load in the range of few watts and which handle large signals to produce large power	-
98	Sink Current	-	The load current that flows through the load connected between Vcc and o/p terminal is called sink current	-
99	SMPS	-	Switched-Mode Power Supply is a power supply that uses a switching regulator to control and stabilize the output voltage by switching the load current on and off.	-
100	Source Current	-	The load current that flows through the load connected between ground and o/p terminal is called source current.	-

UNIT V : SPECIAL ICs				
101	555 Timer	-	This IC is useful for generating accurate time delays and oscillations.	-
102	Linear voltage regulator	-	It is used to maintain a steady voltage. The resistance of the regulator varies in accordance with the load resulting in a constant voltage output.	Volts
103	Applications of 1C 555 timer	-	1. Pulse generator 2. Ramp and square wave genrator 3. Monoshot multivibrator 4. Burglar alarm 5. Traffic light control and 6. Voltage monitor.	-
104	Basic blocks of 555 timers	-	1. A relaxation oscillator 2. R-S flip- flop 3. Two comparators 4. Discharge transistor	-
105	Applications of 555 timer in Astable mode of operation	-	1. FSK generator 2. Pulse-position modulator	-
106	Applications of 555 timer	-	1. Oscillator 2. Pulse Generator 3. Ramp And Square Wave Generator 4. Mono-Shot Multivibrator 5. Burglar Alarm 6. Traffic Light control.	-
107	Operating Modes of A 555 Timer	-	1. Monostable mode 2. Astable mode	-
108	Applications Of 555 Timer	-	1. Oscillator 2. pulse generator 3. ramp and square wave generator d. mono-shot multivibrator 4. burglar alarm 5. Ttraffic light control.	-
109	Major Blocks of 555 Timer	-	1. A relaxation oscillator 2. RS flip-flop 3. Two comparators 4. Discharge transistor	-
110	Voltage Regulators	-	Voltage regulator is an electronic circuit that provides a stable dc voltage independent of the load current, temperature, and ac line voltage variations	-
111	Voltage Regulators Types	-	1. Series / Linear regulators 2. Switching regulators.	-
112	Switched Voltage Regulators	-	Switching regulators are those which operate the power transistor as a high frequency on/off switch	-
113	Voltage-controlled oscillator	-	A voltage-controlled oscillator is an electronic oscillator whose oscillation frequency is controlled by a voltage input	-
114	Applications of Voltage-controlled oscillator	-	1.Electronic jamming equipment. 2.Function generator. 3.Production of electronic music, 4.Phase locked loop. 5.Frequency synthesizers, used in communication	-

115	Parts of series op amp regulator	-	1.Reference voltage circuit 2.Error amplifier 3.Sereies pass transistor 4.Feedback network	-
116	Load regulation	-	Change in output voltage for a change in load current.expressed in millivolts.	-
117	Ripple rejection	-	The IC regulator not only keeps the output voltage constant but also reduces the amount of ripple voltage.expressed in dB.	-
118	Limitations of 723 general purpose regulator	-	1.No short circuit protection 2.Output voltage is fixed.	-
119	Classification of Voltage Regulator	-	1.Series Regulator. 2.Switching regulator.	-
120	Line/Input Regulation	-	Percentage change in the output voltage for a change in the input voltage.expressed in millivolts.	-
121	Application in Monostable mode	-	1.Missing pulse detector 2.Linear ramp generator 3.Frequency divider 4.Pulse width modulation.	-
122	Frequency divider circuit	-	Frequency divider circuit is the basic circuit in digital logic circuit. The circuit function is to divide or drop the frequency of the high frequency signal to get the lower frequency signal for a given frequency signal by division	-
123	Pulse Width modulation	-	Pulse width modulation (PWM) is a modulation technique that generates variable-width pulses to represent the amplitude of an analog input signal	-
124	Linear ramp generators	-	A ramp generator is a circuit that creates a linear rising or falling output with respect to time. The output variable is usually voltage, although current ramps can be created. Linear ramp generators are also known as sweep generators.	-
125	square wave generator	-	The square wave generator is defined as an oscillator that gives the output without any input. ... The square wave generator is also known as Astable Multivibrator or free-running and the frequency of the square wave generator is independent of the output voltage.	-
PLACEMENT QUESTIONS				
126	Communication	-	Communication says as transferring of message from one place to another place called communication.	-
127	Oscillator	-	An oscillator is a circuit that creates a waveform output from a direct current input.	-
128	Resistor	-	It opposes an electric current by producing a voltage drop between its terminals in proportion to the current	-
129	Inductor	-	It is a coil, choke, or reactor.It stores energy in a magnetic field when electric current flows through it.	-
130	Conductor	-	A conductor is an object or type of material that allows the flow of charge in one or more directions.	-
131	Semi-Conductor	-	Semiconductors are materials which have a conductivity between conductors and nonconductors or insulators	-
132	Amplifier	-	An electronic device or electrical circuit that is used to boost (amplify) the power, voltage or current of an applied signal.	-
133	Oscillator	-	An oscillator is a circuit that creates a waveform output from a direct current input.	-

134	Diode	-	A diode is a semiconductor device that essentially acts as a one-way switch for current.	-
135	Transistor	-	In electronics, a transistor is a semiconductor device commonly used to amplify or switch electronic signals.	-
136	Feedback	-	Feedback is a process whereby some proportion of the output signal of a system is passed (fed back) to the input.	-
137	Energy stored in an inductance	-	Energy stored =(1/2) L I^2 Joules where L is in henries and I is in amps.	-
138	Energy stored in a capacitance	-	(1/2) C V^2 Joules where C is in farads and V in volts.	-
139	Form factor	-	The ratio of rms value to average value of an ac quantity is called form factor.	-
140	Peak Factor	-	Peak Factor = Maximum Value/RMS value	-
141	Active components	-	Active components are those electrical components which require an external source for its full operation such as Diode, Transistor, Thyristor etc.	-
142	Passive components	-	Passive components are those components which do not need any external source for its function.	-
143	Norton theorem	-	Any combination of batteries and resistances in a linear circuit is equivalent to and can be represented by an ideal current source and a resistor in parallel.	-
144	Thevenin theorem	-	Any combination of batteries and resistance in a linear circuit can be represented by a signal voltage source and a resistor in series. .	-
145	Regions of operation of a transistor	-	In the active region, the transistor acts as an amplifier. In the saturation region, the transistor acts as a closed switch. In the cutoff region, the transistor acts as an open switch.	-
146	Cutoff Frequency	-	The cutoff frequency is the point in a filter's frequency response where the pass band and stop band meets.	-
147	Pass band	-	The pass band is the range of frequencies that can be passed through the filter without any attenuation.	-
148	Stop band	-	The stop band is the range of frequencies that are attenuated and cannot be passed through the filter.	-
149	Notch filter	-	The notch filter is a type of band stop filter with very narrow stop band.	-
150	Sampling	-	Sampling is a process of converting a continuous time signal into a discrete time signal but not a digital signal.	-

Signatures

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