

**University of Mumbai**  
**Examinations Summer 2022**  
Program: Electronics & Telecommunication  
ECC403: Linear Integrated Circuits

Time: 2 hour 30 minutes

Max. Marks: 80

<b>Q1.</b>	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</b>
1.	With zero volts on both inputs, an OP amp ideally should have an output ...
Option A:	equal to the positive supply voltage
Option B:	equal to the negative supply voltage
Option C:	equal to zero
Option D:	equal to the CMRR
2.	An opamp has a typical open loop gain of 1200 and the common mode rejection of 55 dB. What is the common mode rejection ratio?
Option A:	542
Option B:	562
Option C:	580
Option D:	590
3.	The input stage of an op amp is usually a
Option A:	CE amplifier
Option B:	Class B push pull amplifier
Option C:	Differential amp
Option D:	Swamped amplifier
4.	The op amp can amplify
Option A:	Both ac and dc signals
Option B:	DC signals only
Option C:	AC signals only
Option D:	Neither ac not dc signals
5.	If the bias current in IC 741 opamp is $I_Q = 19 \mu A$ and the internal frequency compensation capacitor $C_1 = 30 \text{ pF}$ , the slew rate of the opamp will be nearly
Option A:	$1.58 \text{ V}/\mu s$
Option B:	$1.26 \text{ V}/\mu s$
Option C:	$0.93 \text{ V}/\mu s$
Option D:	$0.63 \text{ V}/\mu s$
6.	The ideal opamp has
Option A:	Infinite voltage gain and zero input impedance
Option B:	Infinite voltage gain and infinite bandwidth
Option C:	Zero voltage gain and infinite CMRR
Option D:	Zero output impedance and zero CMRR
7.	What is the frequency of oscillation for an R-C phase shift oscillator with R of $10 \text{ k}\Omega$ and C of $0.001 \mu F$ in each of its three RC sections?
Option A:	$5.0 \text{ kHz}$
Option B:	$5.5 \text{ kHz}$

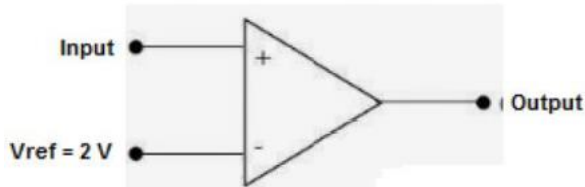
Option C:	6.0 kHz
Option D:	6.5 kHz
8.	For a summing amplifier if $V_1 = -3.3 \text{ V}$ , $V_2 = 0.8 \text{ V}$ , $R_1 = 33 \text{ k}\Omega$ , $R_2 = 10 \text{ k}\Omega$ and $R_F = 330 \text{ k}\Omega$ , calculate the output voltage.
Option A:	0 V
Option B:	6.6 V
Option C:	-4 V
Option D:	2 V
9.	Sustained oscillation in Wein bridge oscillator is possible when the value of $\beta$ is
Option A:	3
Option B:	1/3
Option C:	1
Option D:	2
10.	Op-amp integrator uses:
Option A:	Capacitor as feedback element
Option B:	Resistor as feedback element
Option C:	Inductor as feedback element
Option D:	A simple wire as feedback element
11.	Voltage to current converter is also called as
Option A:	Current series negative feedback amplifier
Option B:	Voltage series negative feedback amplifier
Option C:	Current series positive feedback amplifier
Option D:	Voltage series positive feedback amplifier
12.	Calculate the cut-off frequency of a first-order low-pass filter for $R_F = 2.5 \text{ k}\Omega$ and $C_1 = 0.05 \text{ }\mu\text{F}$ .
Option A:	1.273 kHz
Option B:	12.73 kHz
Option C:	127.3 kHz
Option D:	127.3 Hz
13.	The advantages of precision rectifiers are
Option A:	absence of forward voltage drop
Option B:	absence of forward current drop
Option C:	absence of infinite voltage drop
Option D:	present of infinite voltage drop
14.	Which of this is used as Zero crossing detector
Option A:	inverting or non-inverting comparators
Option B:	inverting and non-inverting comparators
Option C:	inverting or non-inverting amplifier
Option D:	inverting and non-inverting amplifier
15.	The output of Schmitt trigger is
Option A:	triangle waveform
Option B:	sinusoidal waveform
Option C:	sawtooth waveform
Option D:	pulse waveform

16.	In an instrumentation amplifier, the output voltage is based on the _____ times a scale factor.
Option A:	Summation of 2 inputs
Option B:	Product of 2 inputs
Option C:	Difference between 2 inputs
Option D:	Division of 2 inputs
17.	The Purpose of comparator is to
Option A:	Produce a change in input voltage when input voltage is equal to reference voltage
Option B:	detect the occurrence of a changing input voltage
Option C:	amplify an input voltage
Option D:	Maintain a constant output when dc input voltage changes
18.	Why zener diode is used at the output terminal of square wave generator?
Option A:	To reduce both output and capacitor voltage swing
Option B:	To reduce capacitor voltage swing
Option C:	To reduce input voltage swing
Option D:	To reduce output voltage swing
19.	In a 555 timer, a series connection of three resistors sets the reference voltage levels to the two comparators at _____ and _____.
Option A:	VCC, VCC/2
Option B:	VCC/2, VCC/4
Option C:	2VCC/3, VCC/3
Option D:	VCC, VCC
20.	For 555 astable multivibrator, if $C = 0.01 \mu\text{F}$ , $R_A = 10 \text{ k}\Omega$ , $R_B = 50 \text{ k}\Omega$ , the frequency and the duty cycle will be nearly
Option A:	1.6 kHz and 54.5 %
Option B:	1.3 kHz and 54.5%
Option C:	1.6 kHz and 46.5%
Option D:	1.3 kHz and 46.5 %
21.	Multivibrator Circuit that remains in stable state until a triggering signal causes a transition to quasi stable state and returns to stable state after certain time is called
Option A:	Astable multivibrator
Option B:	Monostable multivibrator
Option C:	Bistable multivibrator
Option D:	Unistable multivibrator
22.	The 555 Timer IC got its name from the three $5\text{K}\Omega$ resistors that are used in
Option A:	input frequency network
Option B:	voltage divider network.
Option C:	current divider network.
Option D:	Load network
23.	The time period of a monostable 555 multivibrator is given as .
Option A:	$T = 0.33RC$
Option B:	$T = 1.1RC$
Option C:	$T = 3RC$

Option D:	$T = 3RC$
24.	Output of LM317 is adjustable between
Option A:	5 V and 37 V
Option B:	1.2 V and 37 V
Option C:	10 V and 37 V
Option D:	1.5 V and 37 V
25.	The 7912 regulator IC provides _____ .
Option A:	12V
Option B:	-12V
Option C:	5V
Option D:	-5V
26.	A negative adjustable voltage regulator produces
Option A:	a regulated negative voltage
Option B:	a regulated positive voltage
Option C:	a regulated negative and positive voltage
Option D:	a regulated positive or negative voltage
27.	Switching regulators are series type regulators, which has _____ power dissipation & _____ efficiency.
Option A:	increased, increased
Option B:	increased, reduced
Option C:	reduced, increased
Option D:	reduced, reduced
28.	In IC 723 output current levels upto
Option A:	300 mA
Option B:	200 mA
Option C:	100 mA
Option D:	150 mA
29.	In LM317 voltage regulator, what is the minimum value of voltage required between its input & output in order to supply power to an internal circuit?
Option A:	1V
Option B:	5V
Option C:	3V
Option D:	20V
30.	Which performance parameter of a regulator is defined as the change in regulated load voltage due to variation in line voltage in a specified range at a constant load current?
Option A:	Load regulation
Option B:	Line regulation
Option C:	Temperature stability factor
Option D:	Ripple rejection
31.	When the loop is in lock in a PLL, the input frequency is _____ the output frequency from the VCO.
Option A:	the same as
Option B:	greater than

Option C:	smaller than
Option D:	None of the above
32.	LM 317 is a
Option A:	Voltage regulator
Option B:	Counter
Option C:	Shift register
Option D:	ALU
33.	The change in output voltage for the corresponding change in load current in a 7805 IC regulator is defined as
Option A:	Line regulation
Option B:	Load regulation
Option C:	Input regulation
Option D:	Ripple rejection
34.	In IC 723 a series pass transistor is present at
Option A:	pin 2 and 3
Option B:	pin 10 and 11
Option C:	pin 6 and 7
Option D:	pin 4 and 5
35.	The % load regulation of a power supply should be ideally _____ & practically _____.
Option A:	zero, small
Option B:	small, zero
Option C:	zero, large
Option D:	large, zero
36.	Phase Locked Loop IC 565 consist of
Option A:	input and square wave detector
Option B:	TTL and DTL
Option C:	VCO and phase detector
Option D:	VCO and pulse detector
37.	Operating voltage range of IC565 is
Option A:	$\pm 2V$ to $\pm 12V$
Option B:	$\pm 2V$ to $\pm 10V$
Option C:	$\pm 5V$ to $\pm 10V$
Option D:	$\pm 5V$ to $\pm 12V$
38.	In PLL, the capture range is always _____ the lock range.
Option A:	greater than
Option B:	equal to
Option C:	less than
Option D:	either greater than or equal to
39.	Which of the following best describes the output of a 566 voltage-controlled oscillator?
Option A:	Half rectified sine wave
Option B:	Both square- and triangular-wave
Option C:	Abrupt waveform

Option D:	Full rectified Sine-Wave
40.	How many Vcc connections does the 565 PLL use?
Option A:	0
Option B:	2
Option C:	1
Option D:	3

Q2	5 Marks question
1	For a regulated power supply the output voltage varies from 12V to 11.6 V when the load current is varied from 0 to 100 mA which is the maximum value of $I_L$ . If the ac line voltage and temperature are constant, calculate the load regulation, % load regulation and output resistance of the power supply.
2	Compare ideal and practical opamp.
3	Compare linear and switching regulators.
4	Short note on PLL IC 565.
5	Short note on Precision rectifiers
6	How precision rectifiers are different from ordinary diode rectifiers.
7	Design a circuit for $V_0 = 2V_1 - 3V_2$ using single opamp and few resistors.
8	Short note on three terminal fixed voltage regulators.
9	Design a circuit for $V_0 = V_1 + V_2$ using single opamp and few resistors.
10	Explain opamp as window detector.
11	Short note on voltage to current converter.
12	Explain current to voltage converter.
13	Short note on peak detector circuit.
14	Short note on VCO IC 566.
15	Explain the application of IC 565 as FSK Demodulator.
16	Explain the application of IC 566 as Frequency modulator.
17	Design a monostable multivibrator using IC 555 timer to obtain pulse width of 10 msec.
18	Design a first order low pass filter to provide a cut off frequency of 10 kHz.
19	<p>If the input to the ideal comparator shown in the fig below is a sinusoidal signal of 8 volt peak to peak without any DC component then check whether the duty cycle of the output of comparator is 33.33% or 25% or 20%. Prove it.</p> 
20	Explain zero crossing detector.
21	Draw the circuit diagram of Schmitt trigger to achieve hysteresis of 4V with $UTP = 7V$ , $LTP = 3V$ , $V_{cc} = 12V$ and $V_{ee} = -12V$ .
22	State and explain Barkhausen criteria.
23	Short note on active filters.
24	Compare astable with monostable multivibrator.

25	Explain the block diagram of opamp.
26	Define CMRR, Slew rate, Input offset voltage and input offset current.

<b>Q3</b>	<b>10 marks</b>
1	Draw a neat diagram of RC phase shift oscillator using opamp. Derive its frequency of oscillation. What are the values of R and C for frequency of oscillation to be 1kHz.
2	With the help of neat diagram, input and output waveforms and voltage transfer characteristics explain the working of non-inverting Schmitt trigger. Derive the expression for its threshold levels.
3	With the help of neat diagram, input and output waveforms and voltage transfer characteristics explain the working of inverting Schmitt trigger. Derive the expression for its threshold levels.
4	Design a differentiator to differentiate an input signal that varies in frequency from 10Hz to about 500 Hz. Draw its frequency response. If a sinewave of 2V peak at 500 Hz is applied to a differentiator, write expression for its output and draw output waveform.
5	Draw the circuit diagram of a square and triangular waveform generator using opamp. With the help of waveforms at suitable points in the circuit explain its working. Explain how duty cycle can be varied?
6	Sketch the implementation of an instrumentation amplifier using three opamps and explain its operation.
7	Design a Schmitt trigger circuit to convert 5V, 1kHz sinusoidal signal to square wave using 741IC, $V_{UT} = 0.8\text{ V}$ , $V_{LT} = -0.8\text{ V}$ and $\pm V_{sat} = \pm 11\text{ V}$ . Draw its transfer characteristics, input and output waveforms.
8	Design an IC 555 astable multivibrator for an output frequency 1kHz and a duty cycle of 60%.
9	Design a Wein bridge oscillator using opamp to oscillate at a frequency of 965Hz and explain the working of Wein Bridge oscillator.
10	Design a second order Butterworth high pass filter for a cut off frequency of 1 kHz and pass band gain of 2.
11	With the help of functional block diagram explain the working of voltage regulator LM317.
12	Design a second order low pass filter for a cut off frequency of 1 kHz and passband gain of 1.586.
13	Design a voltage regulator using IC 7805 that will deliver 0.25 A current to a 48 ohm, 10W load.
14	Design a voltage regulator for an output of 15V and output current of 1.5A.
15	Design a voltage regulator using IC 723 to give output voltage of 15V and output current of 150 mA.

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Question	Correct Option
Q1.	C
Q2.	B
Q3.	C
Q4	A
Q5	D
Q6	B
Q7	D
Q8.	B
Q9.	B
Q10.	A
Q11.	A
Q12.	A
Q13.	A
Q14.	A
Q15.	D
Q16.	C
Q17.	A
Q18.	D
Q19.	C
Q20.	B
Q21.	B
Q22.	B
Q23.	B



Q24.	B
Q25.	B
Q26	A
Q27	C
Q28	C
Q29	C
Q30	B
Q31	A
Q32	A
Q33	B
Q34	B
Q35	A
Q36	C
Q37	D
Q38	C
Q39	B
Q40	B