**University of Mumbai**

**Examinations Summer 2022**

Program: Electronics & Telecommunication

ECC403: Linear Integrated Circuits

Time: 2 hour 30 minutes Max. Marks: 80

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| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
| 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 |
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| 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 |
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| 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 |
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| 5. | If the bias current in IC 741 opamp is IQ =19 µA and the internal frequency compensation capacitor C1 = 30 pF, the slew rate of the opamp will be nearly |
| Option A: | 1.58 V/µs |
| Option B: | 1.26 V/µs |
| Option C: | 0.93 V/µs |
| Option D: | 0.63 V/µs |
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| 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 |
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| 7. | What is the frequency of oscillation for an R-C phase shift oscillator with R of 10 kΩ and C of 0.001 µF in each of its three RC sections? |
| Option A: | 5.0 kHz |
| Option B: | 5.5 kHz |
| Option C: | 6.0 kHz |
| Option D: | 6.5 kHz |
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| 8. | For a summing amplifier if V1 = -3.3 V , V2 = 0.8 V, R1 = 33 kΩ, R2 = 10 kΩ and RF = 330 kΩ, 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 ß is |
| Option A: | 3 |
| Option B: | 1/3 |
| Option C: | 1 |
| Option D: | 2 |
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| 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 |
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| 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 |
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| 12. | Calculate the cut-off frequency of a first-order low-pass filter for RF = 2.5 kΩ and C1 = 0.05 μF. |
| Option A: | 1.273 kHz |
| Option B: | 12.73 kHz |
| Option C: | 127.3 kHz |
| Option D: | 127.3 Hz |
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| 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 |
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| 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 |
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| 15. | The output of Schmitt trigger is |
| Option A: | triangle waveform |
| Option B: | sinusoidal waveform |
| Option C: | sawtooth waveform |
| Option D: | pulse waveform |
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| 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 |
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| 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 |
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| 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 |
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| 20. | For 555 astable multivibrator, if C= 0.01 µF, RA = 10 kΩ, RB = 50 kΩ, 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 % |
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| 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 |
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| 22. | The 555 Timer IC got its name from the three 5KΩ resistors that are used in |
| Option A: | input frequency network |
| Option B: | voltage divider network. |
| Option C: | current divider network. |
| Option D: | Load network |
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| 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 |
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| 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 |
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| 25. | The 7912 regulator IC provides \_\_\_\_\_\_\_\_ . |
| Option A: | 12V |
| Option B: | -12V |
| Option C: | 5V |
| Option D: | -5V |
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| 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 |
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| 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 |
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| 28. | In IC 723 output current levels upto |
| Option A: | 300 mA |
| Option B: | 200 mA |
| Option C: | 100 mA |
| Option D: | 150 mA |
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| 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 |
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| 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 |
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| 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 |
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| 32. | LM 317 is a |
| Option A: | Voltage regulator |
| Option B: | Counter |
| Option C: | Shift register |
| Option D: | ALU |
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| 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 |
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| 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 |
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| 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 |
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| 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 |
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| 37. | Operating voltage range of IC565 is |
| Option A: | ±2V to ±12V |
| Option B: | ±2V to ±10V |
| Option C: | ±5V to ±10V |
| Option D: | ±5V to ±12V |
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| 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 |
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| 40. | How many Vcc connections does the 565 PLL use? |
| Option A: | 0 |
| Option B: | 2 |
| Option C: | 1 |
| Option D: | 3 |

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| **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 IL. 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 V0 = 2V1 – 3V2 using single opamp and few resistors. |
| 8 | Short note on three terminal fixed voltage regulators. |
| 9 | Design a circuit for V0 = V1 + V2 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 | 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. |
| 20 | Explain zero crossing detector. |
| 21 | Draw the circuit diagram of Schmitt trigger to achieve hysteresis of 4V with UTP = 7V, LTP=3V, Vcc=12V and Vee=-12V. |
| 22 | State and explain Barkhausean 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. |

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| **Q3** | **10 marks** |
| 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, VUT = 0.8 V, VLT = -0.8 V and ±Vsat = ± 11 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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Time: 2 hour 30 minutes Max. Marks: 80

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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 |