SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

Major Examination (Even Semester) – 2024-25

Entry No: | | | | | | | | |

Total number of pages:[02]

Total number of questions: [03]

B.Tech. || ECE || Sem IV

Linear Integrated Circuits & Applications (ECL DC 202/ECL 2030)

Time allowed: 3 Hr

Max Marks: 40

Important Instructions:

- All questions are compulsory
- Sketch the schematics whenever necessary
- Assume any missing data

Q. 1. (i) Draw a neat sketch of a BJT based differential amplifier. Why this multistage amplifier is essential to construct the op-amp? [5×2 =10] CO1

(ii) Write four ideal characteristics of op-amp. CO2

(iii) Name four diode based op-amp circuit applications and draw any two circuits and their corresponding input-output waveforms. CO3

(iv) What are the different types of analog filters? Draw the basic frequency response graph for each filter. Indicate major points in the graph [no explanation needed]. CO4

(v) For a binary input of 110011, what will be the equivalent output voltage if the signal is passed through a digital to analog converter with a voltage range of 0 to 10 V? CO5

Q. 2. Draw the neat sketch of the following op-amp circuits and explain the working in detail [any four] [5×4 =20]

(i) Schmitt trigger CO3

(ii) Instrumentation amplifier CO3

(iii) Wien Bridge oscillator CO4

(iv) Second order Low pass filter CO4

(v) Monostable multivibrator using 555 timer CO5

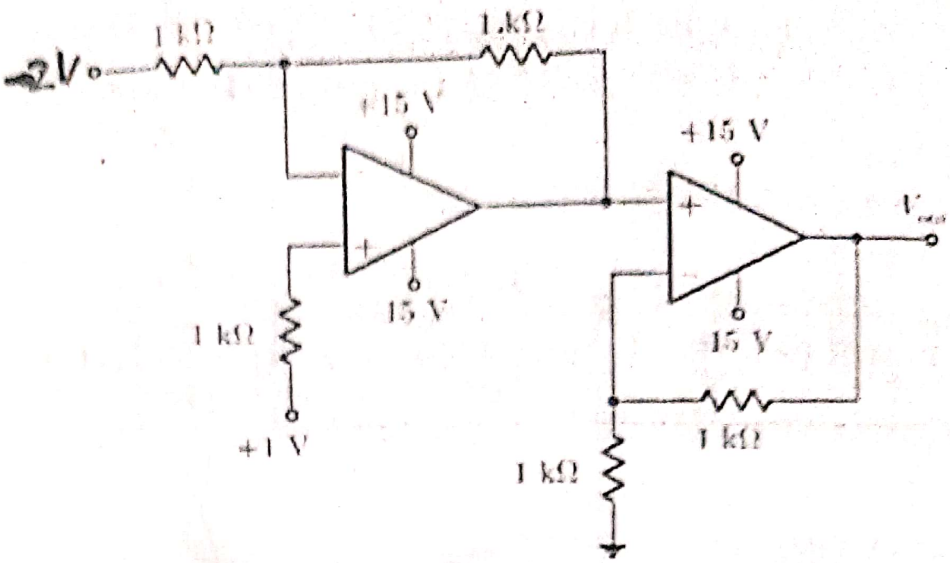
(vi) Dual slope analog to digital converter CO5

Q. 3. (i) In a Widler current mirror, input current is 1.5 mA and output current is 0.2 mA, then find out the value of emitter resistance. [2+2 +4+2 =10] CO1

(ii) Calculate the frequency of operation and duty cycle for the astable multivibrator output, if C= 0.1 μF, R_A=10 KΩ & R_B= 20 KΩ? CO5

(iii) Design a narrow band pass filter with quality factor 15 and frequency of operation 10 KHz. [no need to proof mathematical expression but show each design step] CO4

(iv) In the following circuit inputs are respectively -2 V and +1 V. Calculate the output voltage V_{out}.



Course outcome	Q. N
To understand the basic blocks of op-amp IC	1(i), 3
To understand the basic characteristics and frequency response analysis of op-amp	1(ii)
To be able to understand the linear and nonlinear applications of op-amp	1(iii), 2(i-ii
To be able to design active filters and wave generators using op-amp	1(iv), 2(iii-iv
To be introduced about some specialized IC applications of op-amp	1(v), 2(v-vi

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

Entry No: | | | | | | | | |

Minor-I (Even Semester) – 2022-23

Total number of pages:[01]

Total number of questions: 03

B.Tech. || ECE || Sem IV

Linear Integrated Circuits & Applications (ECL-2030)

Time allowed: 1.5 Hr **Max Marks: 20**

Important Instructions:

- All questions are compulsory
- Sketch the schematics whenever necessary
- Assume any missing data

Q. 1. (a) Why op amp circuits are specified as linear integrated circuits? [1×6=6] CO1

(b) What is the value of supply voltage rejection ratio and common mode rejection ratio in an ideal op-amp?

(c) Define the following terms: (i) Input bias current (ii) output offset voltage.

(d) With neat sketch note down the different types of feedback done in op amp

(e) Why frequency compensation is necessary in op amp?

(f) What is the importance of slew rate in op amp?

Q. 2. (a) Derive the expression for DC biasing point and differential gain in a dual input balanced output differential amplifier. [4+4=8] CO2

(b) Draw the frequency equivalent model of an op-amp with single break frequency and derive the expression for open loop voltage gain as a function of frequency. Also draw the Bode plot if open loop gain $A=1.5\times10^5$ and the break frequency $f_0=100$ Hz. CO2

Q. 3. (a) An inverting open loop op amp has following specifications: $A=2\times10^5$, power supply = ±15 volt. Determine the output of the op amp if input is given as (i) 5 μV, (ii) 5 mV [2+4] CO1

(b) An op amp with noninverting configuration with has following specifications: $A=2\times10^5$, $R_I=2$ MΩ, $R_O=60$ Ω, $R_1=2$ K and $R_F=30$ K. Calculate all the major feedback parameters. [consider all standard notations] CO2

Sl. No.	Course outcome	Q. No.	Total marks
1	To understand the basic characteristics of op-amp	1, 3(a)	

B. Tech. Major Exam, 2022-23

Entry No: | | | | | | | | | |

Total Number of Pages: [02]

Date: 30-06-2022

Total Number of Questions: [16]

Course Title: Linear Integrated Circuits and Applications

Course Code: ECL 1030

Time Allowed: 3 Hour

Max Marks: [50]

Instructions / NOTE

i. **Attempt All Questions.** Scientific Calculator is allowed.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume an appropriate data / information, wherever necessary / missing.
iv. **Q1-Q6: 5 marks each; Q7-Q16: 2marks each.**

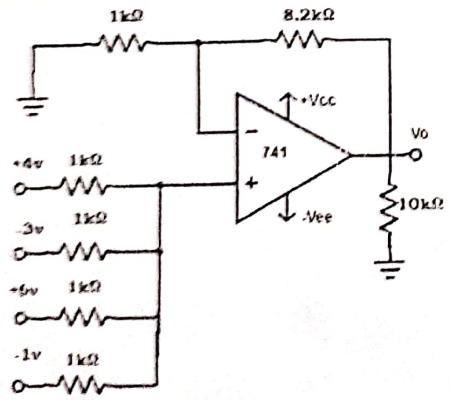
Section: A (6*5=30)

Q1. Explain 555 Timer also describe Mono stable and Astable Multi vibrator using IC 555.	**Q2.** What is oscillator? Explain working principle of oscillator also explain Wein bridge oscillator with its application.
Q3. What are Active Filters? Explain Butterworth Filters with its advantages and drawbacks.	**Q4.** Explain differentiator, integrator and logarithmic amplifier and derive the gain and draw response for the same.
Q5. Explain working principle of Schmitt Trigger also explain Sample and Hold Circuit.	**Q6.** Explain with Block diagram Representation of Feedback Configurations.

Part-B (10*2=20) Choose correct option

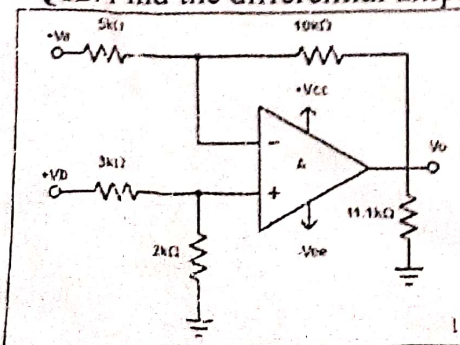
Q7. Theoutput voltage of phase detector is a)Phase voltage b)Free running voltage c)Error voltage d) None of the mentioned	**Q8.** At which state the phase-locked loop tracks any change in input frequency? a)Free running state b)Capture state c)Phase locked state d) All of the mentioned
Q9. The value of emitter resistance in Emitter Biased circuit are RE1=25kΩ & RE2=16kΩ.Find,RE a)9.756kΩ b)41kΩ c)9.723kΩ d) 10kΩ	**Q10.** In ideal Differential Amplifier, if same signal is given to both inputs, then output will be a)Same as input b)Double the input c)Not equal to zero d) Zero

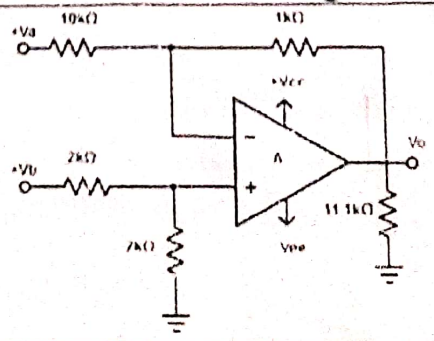
Q11. Find the value of V_1 in the circuit shown below?

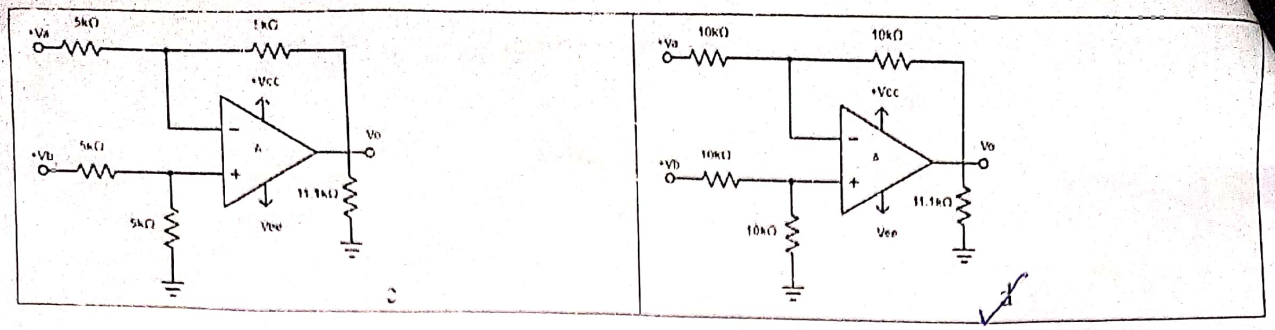


a)4v
b)2v
c)3v
d) None of the mentioned

Q12. Find the differential amplifier configured as a subtractor from the given circuit.

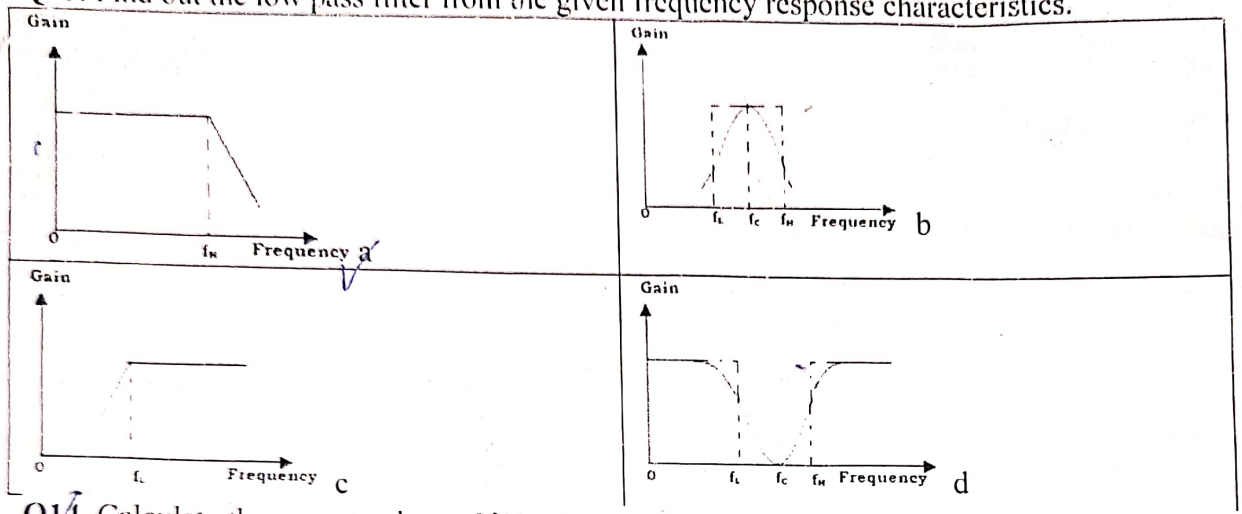




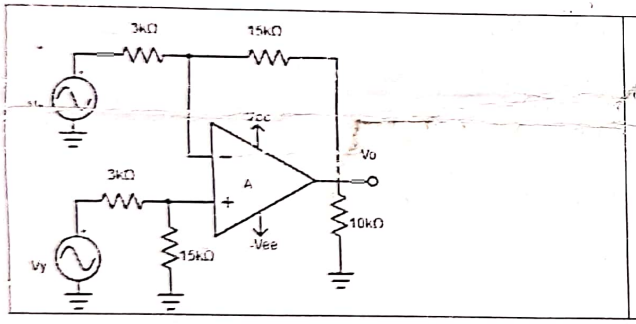


c d

Q13. Find out the low pass filter from the given frequency response characteristics.



Q14. Calculate the output voltage. If V_x=3.9Vpp and V_y = 5.5 Vpp sine wave at 1khz for the following circuit.



a)11Vpp sine wave at 1Khz
b)-8Vpp Vpp sine wave at 1Khz
c)-10 Vpp sine wave at 1Khz
d) 6 Vpp sine wave at 1Khz

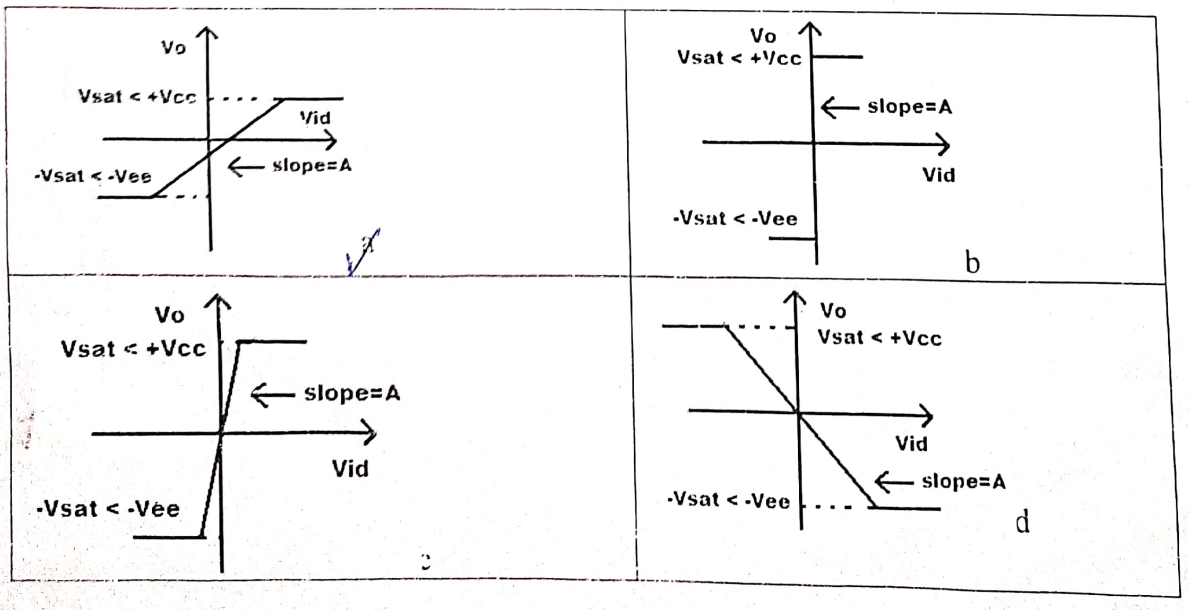
$V_{02} = -\frac{R_f}{R_1} V_{in}$

$= -\frac{15}{3} \times 3.9$

$V_0 = (1+5/5.5$

Q15. What is VCO?

Q16. Find the ideal voltage transfer curve of a normal op-amp.



Shri Mata Vaishno Devi University Katra Jammu & Kashmir

SOECE

B.Tech Mid Term Examination 2021-22

Entry No: | | | | | | | | |

Linear Integrated Circuits and Applications- ECE- IV Sem

ECL 1030

MM: 30

Date:19.04.2022

Time:90 min

Note: All compulsory. Section A 1.5 marks each and Section B 3 marks each.

Section-A (1.5*10=15marks)

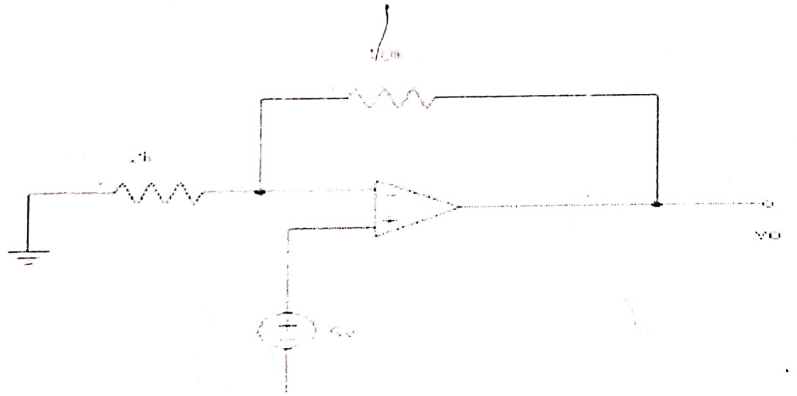
Q1. Why is frequency compensation required in operational amplifier?

Q2. Mention some of the linear applications of op – amps.

Q3. Define virtual ground property of Op-amp.

Q4. What is Voltage follower?

Q5. For the op-amp shown, determine the voltage gain.



Q6. A differential amplifier .....

1. is a part of an Op-amp
2. has one input and one output
3. has two outputs
4. answers (1) and (2)

Q 7. When a differential amplifier is operated single-ended, ...

1. the output is grounded
2. one input is grounded and signal is applied to the other
3. both inputs are connected together
4. the output is not inverted

Q8. In differential-mode, ...

1. opposite polarity signals are applied to the inputs

2. the gain is one
3. the outputs are of different amplitudes
4. only one supply voltage is used

Q9. In the common mode, ...

1. both inputs are grounded
2. the outputs are connected together
3. an identical signal appears on both the inputs
4. the output signal is in-phase

Q10. The common-mode gain is .....

1. very high
2. very low
3. always unity
4. unpredictable

Section-B (3*5=15 marks)

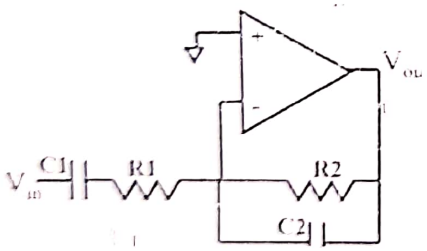
Q11. With diagram explain the operation of inverting and non-inverting amplifier.

Q12. With relevant circuits, explain the following applications of OPAMP.

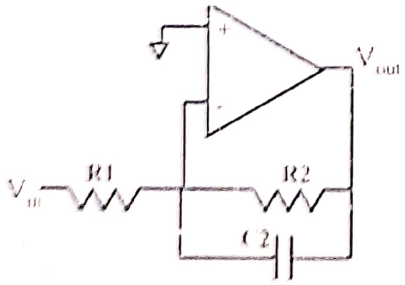
(i) Voltage to current converters

(ii) Multiplier

Q13. Find gain and draw frequency response for the circuit given-



Q14. Draw gain and phase plot for the circuit given-



Q15. What is Integrated Circuit? Package Types, Pin Identification and Temperature-Ranges?

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Entry No: | | | | | | | | |

...amination (Even Semester) – 2022-23 ...SITY, KATRA

Total number of pages:[02]

Total number of questions: 05

B.Tech. || ECE || Sem IV

Linear Integrated Circuits & Applications (ECL-2030)

Time allowed: 3 Hr

Max Marks: 50

Important Instructions:

- All questions are compulsory
- Sketch the schematics whenever necessary
- Assume any missing data

Q. 1. Write full statement in answer sheet to give answer of following questions. [1×10 =10]

(i) In a ideal op-amp slew rate is _____ common mode gain is_____ CO1

(ii) Instrumentation amplifier is used to measure_____ and comparator is used to_____ CO2

(iii) In an ideal inverting op-amp amplifier configuration, instead of resistor, capacitor is placed at input side to work as a _____ and in feedback path to work as a_____ CO2

(iv) A notch filter is used as_____ and RC phase shift oscillator is used to generate_____ CO4

(v) Gain of ideal high pass filter is_____ and low pass filter is_____ at t=0 CO4

(vi) Astable multivibrator has _____ number of stable state and _____ number of unstable state. CO5

(vii) Why $-V_{EE}$ is used in op-amp IC instead of ground? CO1

(viii) Briefly explain the voltage transfer curve of op amp. CO1

(ix) What is the difference between narrowband and wide band pass filter? CO4

(x) For a binary input of 1101, what will be the equivalent output voltage if the signal is passed through a 4-bit D/A converter with a range of 0 to 10 V? CO5

Q. 2. Draw the neat sketch of the following op-amp circuits and respective input-output waveforms [label each point clearly whenever necessary, no need to explain the circuit] [2×5 =10] CO2

(i) Inverting summing amplifier

(ii) Peak detector

(iii) Sample and hold circuit

(iv) Voltage limiter

(v) Square wave generator

Q. 3. (a) What is the need of current mirror in internal circuitry of op-amp? Derive the expression of output current in the Widler current mirror. [5+2+3=10]

(b) What is the need of frequency compensation in op-amp? Define break frequency and bandwidth in a compensated op-amp.

(c) Design a op amp circuit to get the output as $V_{out}=5V_{in1}-3V_{in2}+2V_{in3}$

Q. 4. (a) Explain the working of a Dual slope Analog to Digital Converter. [5+5=10]

(b) What is Barkhausen criterion for oscillation in electronic circuits? Derive the condition for oscillation in a Wien bridge oscillator.

Q. 5. (a) Design a second order low pass Butterworth filter for 3 dB cutoff frequency of 5 KHz. Also draw the frequency response graph. [5+4+1=10]

(b) With a suitable internal circuit diagram, explain the working of a monostable multivibrator designed using a 555 timer.

(c) Calculate the duty cycle for the astable multivibrator output, if C= 0.1 μF, R_A=10 KΩ & R_B= 20 KΩ?

Sl. No.	Course outcome	Q. No.	Total marks
1.	To understand the basic design concept of Operational amplifier IC	1(i, vii, viii), 3.a	8
2.	To study the applications of op-amp	1 (ii, iii), 2, 3.c, 4.a	20
3.	To be able to perform the Frequency response analysis of Op-amp	3.b	2
4.	To be able to design active filters and oscillators using Op-amp	1 (iv, v, ix), 4.b, 5.a	14
5.	To be introduced about some specialized IC applications of OP-amp	1.vi, x,5.b-c	6

VAISHNO DEVI UNIVERSITY, KATRA

Minor-2 (Even Semester) – 2022-23

Entry No:

Total number of pages:[01]

Total number of questions: [03]

B.Tech. || ECE || Sem IV

Linear Integrated Circuits and Applications

Subject Code: ECL-2030

Time allowed: 1.5 Hr

Max Marks: 20

Important Instructions:

1. All questions are compulsory 2. Assume any missing data 3. Draw neat sketch whenever necessary

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Q1. (a) What is the need of Closed loop op-amp with negative feedback? [2×5 =10] [CO1]

(b) Draw the circuit and corresponding output waveform for following op-amp based circuits. [CO1]

(i). Voltage limiter (ii) Negative clipper

(c) What are the advantages of op amp based half wave rectifiers over simple diode based rectifiers? [CO1]

(d) Design an op amp based amplifier circuit which will ensure the purity of ac output? (draw the circuit and explain the concept in brief) [CO1]

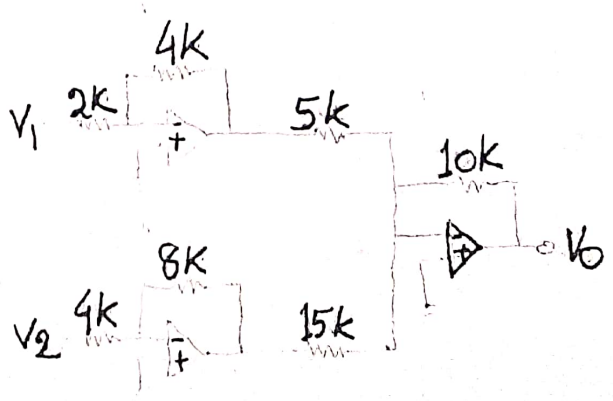
(e) Design a practical integrator circuit which has cut off frequency of 1 KHz. [CO1]

Q2. (a) With a neat sketch. discuss the working principle of sample and hold circuit. [3+2 =5] [CO1]

(b) A schmitt trigger circuit is having input resistance R_1=200 Ω and feedback resistance R_2=4 KΩ with supply voltage of ±12 V. Determine the threshold voltages V_{UT} and V_{LT}. Also calculate the hysteresis voltage V_{Hy}. [CO1]

Q3. (a) Design an op amp circuit which can measure the change of resistance of strain gauge. [3+2 =5] [CO1

(b) Determine the output voltages for following circuit where V_1= 0.3 V and V_2=0.5 V



Mapping of Course Outcomes

Course outcomes	Questions	Marks