SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

III SEMESTER

1905304-ANALOG ELECTRONICS

Regulation – 2019

Academic Year 2022 - 2023

(ODD SEMESTER)

Prepared by

Mr.S.Balaji, Assistant Professor (O.G) /EEE

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603203.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

SUBJECT : 1905304-ANALOG ELECTRONICS
SEM/ YEAR: III / II YEAR EEE

UNIT I - ELECTRONIC DEVICES AND THEIR CHARACTERISTICS

PN junction diodes – structure, operation and VI characteristics: drift and diffusion current, transient capacitance – BJT, JFET, MOSFET: structure, operation and characteristics; biasing; UJT based relaxation oscillator.

PART - A

Q. No	Questions	BT Level	Domain	COs
1.	What is depletion region in PN junction?	BTL 1	Remembering	CO1
2.	Draw the VI Characteristics of the PN Diode.	BTL 1	Remembering	CO1
3.	What is Reverse saturation current?	BTL 1	Remembering	CO1
4.	What is forward bias and reverse bias in a PN junction?	BTL 3	Applying	CO1
5.	Define the term diffusion current.	BTL 1	Remembering	CO1
6.	With suitable expression model transition capacitance and Diffusion capacitance?	BTL 3	Applying	CO1
7.	What is break down? What are its types?	BTL 4	Analyzing	CO1
8.	Collector region of transistor is larger than emitter. Why?	BTL 1	Remembering	CO1
9.	Predict the diffusion capacitance for a silicon diode with a 10 mA forward current, if the charge carrier transit time is 60ns.	BTL 3	Applying	CO1
10	Why BJT is called current controlled device?	BTL 1	Remembering	CO1
11.	The transistor has I_E = 10 mA and α = 0.98. Find the value of base and collector currents.	BTL 5	Evaluating	CO1
12.	Draw the characteristics of CE configuration.	BTL 2	Understanding	CO1
13.	Define current amplification factor in BJT.	BTL 2	Understanding	CO1
14.	Discuss the major difference between a bipolar & unipolar device?	BTL6	Creating	CO1
15.	Give some applications of BJT.	BTL 4	Analyzing	CO1
16.	Compare JFET with BJT.	BTL 5	Evaluating	CO1
17.	In which region JFET acts as a resistor & why?	BTL 1	Remembering	CO1
18.	Draw the transfer characteristics curve for JFET.	BTL 2	Understanding	CO1
19.	Write some applications for JFET.	BTL 2	Understanding	CO1
20.	Discuss the N channel MOSFET with P channel MOSFET.	BTL 6	Creating	CO1
21.	Why FET is called voltage controlled device?	BTL 4	Analyzing	CO1
22.	Draw the V-I characteristics curve of MOSFET.	BTL 1	Remembering	CO1
23.	Compare MOSFET with JFET.	BTL 5	Evaluating	CO1
24.	Give the applications of UJT.	BTL 2	Understanding	CO1

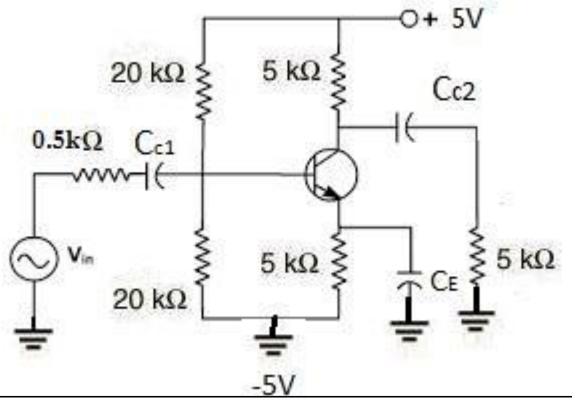
PART - B

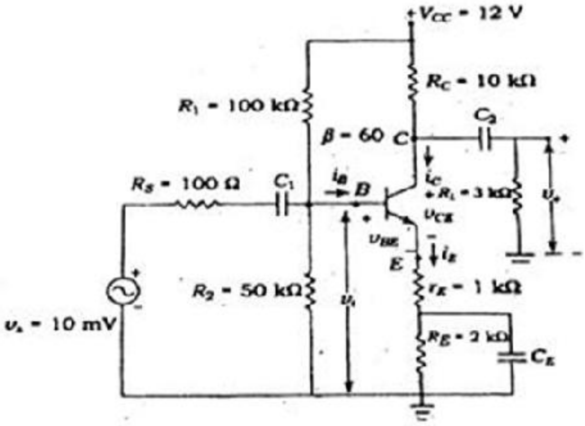
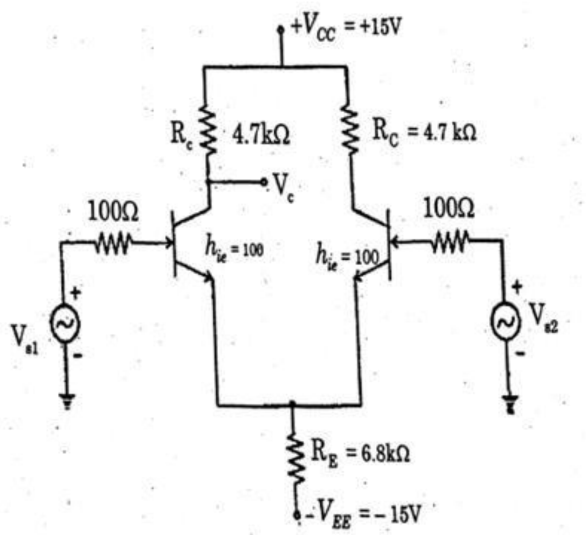
1.	With neat sketch compose the construction, operation and its characteristics of PN junction diode. Also list its advantages, disadvantages and its applications.	13	BTL3	Applying	CO1

2.	(i) Summarize the effect of temperature on PN junction diode and draw its switching characteristics. (ii) The reverse saturation of a silicon PN junction diode is 10μA. Infer the diode current for the forward bias voltage of 0.6V at 25°.	8 5	BTL 2 BTL 2	Understanding Understanding	CO1 CO1
3.	Explain the drift and diffusion currents for PN diode.	13	BTL 4	Analyzing	CO1
4.	Derive the quantitative theory of PN diode currents.	13	BTL 2	Understanding	CO1
5.	Explain details about the switching characteristics on PN diode with neat Sketch.	13	BTL 4	Analyzing	CO1
6.	Explain the operation of NPN and PNP transistors.	13	BTL 6	Creating	CO1
7.	(i) Explain the input and output characteristics of a transistor in CB configuration. (ii)Give the comparison of CE, CB, and CC configuration.	8 5	BTL 2 BTL 2	Understanding Understanding	CO1 CO1
8.	Draw the circuit diagram of a NPN transistor CE configuration and the input and output characteristics. Also define its operating regions.	13	BTL 1	Remembering	CO1
9.	(i) Explain the input and output characteristics of a transistor in CC configuration. (ii) Give the relationship between α, β and γ of a transistor.	8 5	BTL 1 BTL 1	Remembering Remembering	CO1 CO1
10.	The reverse leakage current of the transistor when connected in CB configuration is 0.2 mA and it is 18μA when the same transistor is connected in CE configuration. Determine αdc & βdc of the transistor. Assume IB =30mA.	13	BTL 5	Evaluating	CO1
11.	With necessary circuit and waveform, explain the switching characteristics of a transistor in detail.	13	BTL3	Applying	CO1
12.	Explain the selection of Q point for a transistor bias circuit and discuss the limitations on the output voltage swing.	13	BTL 4	Analyzing	CO1
13.	Explain the operation of JFET and derive the drain and transfer characteristics.	13	BTL 5	Evaluating	CO1
14.	With neat diagram explain the working of Enhancement MOSFET & Depletion MOSFET with its necessary characteristics curve.	13	BTL3	Applying	CO1
15.	(i)Compare N-with P-channel MOSFETS. (ii)Compare P-channel JFET with N-channel JFET.	7 6	BTL 2	Understanding	CO1
16.	(i) Give some characteristics of MOSFET. (ii) Explain the operation of dual gate MOSFET.	7 6	BTL 1 BTL 1	Remembering Remembering	CO1 CO1
17.	(i) The operation of UJT as a relaxation oscillator and derive its frequency of oscillation. (ii) Mention the advantages & applications of UJT.	7 6	BTL 4 BTL 4	Analyzing Analyzing	CO1 CO1
PART - C					
1.	Depletion region decreases during Forward bias and increases during Reverse bias in the case of a p-n junction diode.-justify	15	BTL 5	Evaluating	CO1
2.	(i) Summarize the input and output characteristics of an Emitter Follower. (ii) Compare and contrast between CE, CB and CC configurations.	8 7	BTL 6 BTL 6	Creating Creating	CO1 CO1
3.	Explain in detail, different biasing methods for a transistor circuit with neat circuit diagram and obtain respective stability factors.	15	BTL 4	Analyzing	CO1

4.	Explain the working of a P channel JFET and draw the V-I characteristics of it.	15	BTL 4	Analyzing	CO1
5.	(i)Explain the self-biasing of a JFET. (ii) In a self-bias n-channel JFET, the operating point is set to be at ID = 1.5mA and VDS = 10V the parameters are IDSS =5mA and VGS (off) = -2V. Find the value of RS and Ro if VDD=20V.	8 7	BTL 5 BTL 5	Evaluating Evaluating	CO1 CO1

UNIT II- AMPLIFIER CIRCUITS					
BJT small signal model – Analysis of CE amplifier , Gain and Frequency response – Differential Amplifier - Multi-stage amplifier - Common mode and Differential mode analysis - Current mirror circuits - Introduction to internal circuit of typical OPAMP.					
PART - A					
Q. No	**Questions**		**BT Level**	**Domain**	**COs**
1.	Define h parameters?		BTL 1	Remembering	CO2
2.	Sketch the hybrid model of BJT in CE and CB configuration.		BTL 1	Remembering	CO2
3.	Write about amplifiers and mention its applications.		BTL 1	Remembering	CO2
4.	Model the small signal equivalent circuit of a CE amplifier		BTL 6	Creating	CO2
5.	Express the term bandwidth and gain bandwidth product.		BTL 1	Remembering	CO2
6.	State Miller's theorem.		BTL 1	Remembering	CO2
7.	What are the limitations of h-parameters?		BTL 2	Understanding	CO2
8.	Draw a small signal equivalent circuit of CE amplifiers		BTL 2	Understanding	CO2
9.	Define frequency response.		BTL 3	Applying	CO2
10.	List the applications of differential amplifier.		BTL 1	Remembering	CO2
11.	Analyze how the differential amplifier can be used as an emitter coupled phase inverter		BTL 4	Analyzing	CO2
12.	A multistage amplifier employs five stages of which each has a power gain of 30. Determine the total gain of the amplifier in dB.		BTL 3	Applying	CO2
13.	Define Multi-stage amplifier.		BTL 3	Applying	CO2
14.	Distinguish common mode gain.		BTL 4	Analyzing	CO2
15.	Define Common Mode Rejection Ratio		BTL 2	Understanding	CO2
16.	Distinguish difference mode gain.		BTL 4	Analyzing	CO2
17.	What is common mode in differential amplifier?		BTL 1	Remembering	CO2
18.	Why current mirror circuit is used in differential amplifier?		BTL 5	Evaluating	CO2
19.	What is the use of current mirror circuit?		BTL 6	Creating	CO2
20.	Distinguish current mirror in BJT?		BTL 4	Analyzing	CO2
21.	Write short note on Cascode current mirror circuit.		BTL 2	Understanding	CO2
22.	Define Operational amplifier?		BTL 3	Applying	CO2
23.	Draw the internal circuit of OPAMP.		BTL 2	Understanding	CO2
24.	What are the ideal characteristics of OPAMP?		BTL 5	Evaluating	CO2
PART - B					
1.	Illustrate the h-parameter model of a BJT-CE amplifier and derive the equations for voltage gain, current gain, input impedance and output impedance.	13	BTL 2	Understanding	CO2
2.	Analyze the operation of CE amplifier and derive the expression for h parameters of the same. Also derive the expression for gain, input impedance and output impedance of CE amplifier.	13	BTL 4	Analyzing	CO2
3.	The hybrid parameters of a transistor used as an amplifier in the CE configuration are hie = 800Ω, hfe = 46, hoe = 80 × 10-6 and hre = 5.4× 10-4. If R_L = 5kΩ and Rs =500Ω. Find Ai, Ri, Av, Ro.	13	BTL 5	Evaluating	CO2
4.	Determine the mid-band gain and bandwidth of a CE amplifier shown in the figure. Assume lower cutoff frequency is 100Hz .Let hfe =β =100, cbe = 4pF, cbc=0.2pF and VA = ∞.	13	BTL 5	Evaluating	CO2

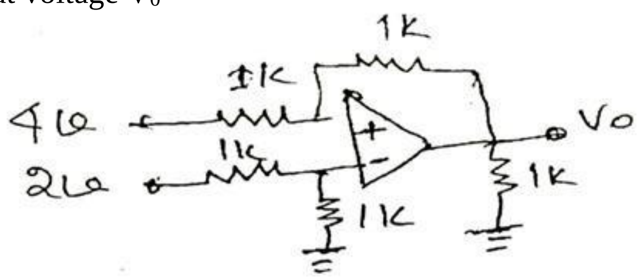
					
5.	(i) Show the low frequency h-equivalent model of a transistor amplifier operating in CE mode and write why this circuit is not valid for high frequencies. (ii) Define the trans conductance of BJT in the CE mode. How it is related to h parameters.	8 5	BTL 1 BTL 1	Remembering Remembering	CO2 CO2
6.	Demonstrate the mid band analysis of single stage CE, CB and CC amplifiers.	13	BTL 3	Applying	CO2
7.	Explain in detail about cascaded amplifiers	13	BTL 4	Analyzing	CO2
8.	With neat sketch explain two stage cascaded amplifier and derive its overall Av, A_I, R_I and Ro.	13	BTL 3	Applying	CO2
9.	Discuss in detail about multi-stage amplifier.	13	BTL 2	Understanding	CO2
10.	Derive the equation for differential mode gain and common mode gain of a differential amplifier	13	BTL 4	Analyzing	CO2
11.	With neat sketch, explain the BJT differential amplifier with active load and derive Ad, Ac and CMRR. How CMRR can be improved?	13	BTL 1	Remembering	CO2
12.	Develop the equation for differential mode gain and common mode gain of a differential amplifier using BJT. Derive the expression for differential mode gain and common mode gain.	13	BTL 3	Applying	CO2
13.	Illustrate the circuit of emitter coupled BJT differential amplifier, and derive expressions for differential gain, common mode gain and CMRR.	13	BTL 1	Remembering	CO2
14.	The dual input balanced output differential amplifier having Rs=100Ω, RC =4.7kΩ, R_E =6.8kΩ, hfe=100,Vcc=+15V, VEE=-15V. Find operating point values, differential &common mode gain, CMRR and output if Vs1=70mV(p-p) at 1kHz and Vs2=40mV(p-p).	13	BTL 6	Creating	CO2
15.	Implement Current mirror circuits using BJT.	13	BTL 6	Creating	CO2
16.	Draw the circuit of a differential amplifier with current Mirror load. Draw its equivalent circuit and derive an expression for its gain	13	BTL 1	Remembering	CO2
17.	Define CMRR. Draw the circuit of an Op-amp differential amplifier and give the expression for CMRR.	13	BTL 2	Understanding	CO2
PART - C					
1.	Derive the expression for current gain, input impedance and voltage gain of a CE Transistor Amplifier	15	BTL 4	Analyzing	CO2
2.	Using the hybrid equivalent model, analyze and deduce the expression for the parameters using the circuit sketch.	15	BTL 5	Evaluating	CO2

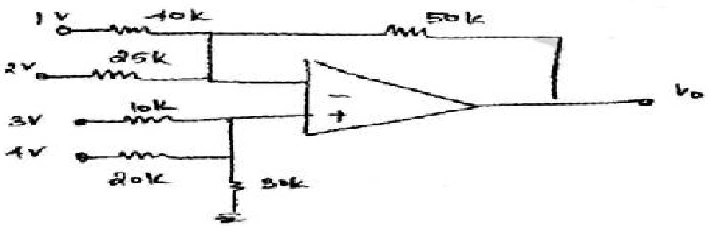
3.	The following figure shows a common emitter amplifier. Determine the input resistance, ac load resistance, voltage gain and output voltage. 	15	BTL 5	Evaluating	CO2
4.	Evaluate the operating point, differential gain, common mode gain, CMRR and output voltage if V_{S1}=70 mV peak to peak at 1kHz and V_{S2}=40mV peak to peak at 1kHz of dual input balanced output differential amplifier hie=2.8kΩ. 	15	BTL 6	Creating	CO2
5.	Draw and Explain the internal block diagram of an op-amp circuit.	15	BTL 4	Analyzing	CO2

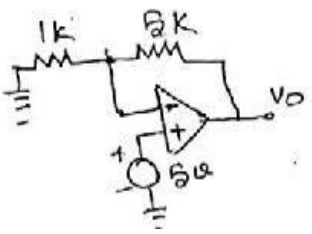
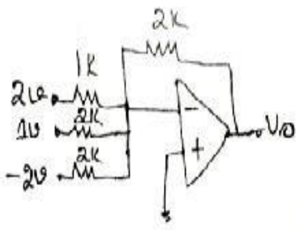
UNIT III- OPAMP AND CHARACTERISTICS

Ideal OPAMP characteristics, DC characteristics, AC characteristics, Voltage -series feedback and voltage -shunt feedback - Frequency response of OPAMP - Basic applications: inverting, non-inverting and differential amplifier circuits, Adder- subtractor circuits - Differentiation and integrator circuits.

PART - A

Q. No	Questions	BT Level	Domain	COs
1.	What is an OP-Amp? Write the circuit symbol of an OP-Amp.	BTL 1	Remembering	CO3
2.	List out the ideal characteristics of an OP-AMP.	BTL 1	Remembering	CO3
3.	Compare the ideal and practical op-amp characteristics.	BTL 4	Analyzing	CO3
4.	A 100 pF capacitor has a maximum charging current of 100 micro amps. Calculate its slew rate.	BTL 3	Applying	CO3
5.	Define virtual ground concept	BTL 2	Understanding	CO3
6.	Write some applications of operational amplifier.	BTL 1	Remembering	CO3
7.	Analyze what happens when the common terminal of V+ and V- sources are not grounded?	BTL 4	Analyzing	CO3
8.	What do you mean by input offset current and offset voltage?	BTL 1	Remembering	CO3
9.	Compose Voltage series feedback.	BTL 5	Evaluating	CO3
10.	Compose Voltage shunt feedback.	BTL 5	Evaluating	CO3
11.	Differentiate between open loop gain and closed loop gain.	BTL 2	Understanding	CO3
12.	Draw the circuit diagram of a symmetrical emitter coupled differential amplifier.	BTL 2	Understanding	CO3
13.	Sketch an adder circuit to using an op-amp to get the output expression as $V0= -(0.1V_1+V_2+10V_3)$ where V1, V2 and V3 are the inputs.	BTL 3	Applying	CO3
14.	What is the drawback of IC 741?	BTL 1	Remembering	CO3
15.	Draw and write the output voltage equation of inverting amplifier.	BTL 2	Understanding	CO3
16.	Draw and write the output voltage equation of Non-inverting amplifier.	BTL 2	Understanding	CO3
17.	For the circuit diagram shown below determine the output voltage V_0 	BTL 5	Evaluating	CO3
18.	Why IC 741 is not used for high frequency applications?	BTL 4	Analyzing	CO3
19.	Design an amplifier with a gain of -10 and input resistance of 10kΩ.	BTL 6	Creating	CO3
20.	compose how an op-amp can be used as a voltage follower?	BTL 6	Creating	CO3
21.	Determine the input impedance of 741 operational amplifier employed as voltage follower having Av =50,000 and Ri = 0.3Mega Ohm.	BTL 3	Applying	CO3
22.	Examine the circuit diagram of differentiator using Op-amp.	BTL 1	Remembering	CO3
23.	What is integrator?	BTL 1	Remembering	CO3
24.	Draw the circuit diagram of an integrator and give its output equation.	BTL 2	Understanding	CO3

PART – B					
1.	List the six characteristics of an ideal op-amp and explain in detail and give the practical op-amp equivalent circuit.	13	BTL 1	Remembering	CO3
2.	Explain the following terms in an op-amp (i) Bias current. (ii) Thermal drift. (iii) Input offset voltage and current. (iv) Virtual ground.	 3 3 4 3	BTL 1	Remembering	CO3
3.	Discuss in detail about the DC and AC characteristics of opamp.	13	BTL 2	Understanding	CO3
4.	(i) What is input and output voltage and current offset? How are they compensated? (ii) With a neat diagram derive the AC performance close loop characteristics of Op-amp to discuss on the circuit Bandwidth, Frequency response and slew rate.	7 6	BTL 1	Remembering	CO3
5.	Discuss in detail about Voltage -series feedback and voltage -shunt feedback amplifier of opamp.	13	BTL 2	Understanding	CO3
6.	(i) Determine the frequency response characteristics of an operational amplifier.	7	BTL 3	Applying	CO3
	(ii) How common mode rejection ratio can be increased using constant current source?	6	BTL 3	Applying	CO3
7.	(i) Write a note on stability criterion applicable to op-amp circuit.	3	BTL 2	Understanding	CO3
	(ii) Explain in detail about the methods of frequency compensation used in operational amplifiers.	10	BTL 2	Understanding	CO3
8.	(i) What is Slew rate? Analyze the causes of slew rate and explain its significance in applications.	9	BTL 4	Analyzing	CO3
	(ii) Analyze how slew rate can be improved.	4	BTL 4	Analyzing	CO3
9.	(i) Draw the inverting amplifier circuit and non-inverting amplifier circuit of an op-amp in closed loop configuration. Obtain the expression for the closed loop gain for both amplifiers.	10	BTL 3	Applying	CO3
	(ii) For a non-inverting amplifier using an op-amp assume R1 = 470 ohm and R2 = 4.7kohm. Calculate the closed loop voltage gain of the amplifier.	3	BTL 3	Applying	CO3
10.	Draw and explain the working principle symmetrical emitter coupled differential amplifier and derive for CMRR.	13	BTL 1	Remembering	CO3
11.	Explain the differential amplifier using opamp.	13	BTL 1	Remembering	CO3
12.	(i) Examine the functions of all the basic building blocks of an Op-Amp.	7	BTL 4	Analyzing	CO3
	(ii) Explain the application of op-amp as adder and Subtractor.	6	BTL 4	Analyzing	CO3
13.	Compare and contrast Adder, Subtractor, and Averaging circuit using op-amp with equations.	13	BTL 2	Understanding	CO3
14.	(i) Write the application of op-amp as differentiator.	7	BTL 1	Remembering	CO3
	(ii) Calculate Vo for the given circuit. 	6	BTL 3	Applying	CO3

15.	State and explain about CMRR, Ad, Ac and suggest a method to improve CMRR.	13	BTL 4	Analyzing	CO3
16.	(i) Deduce an op-amp circuit to give an output voltage$V0 = 4V_1 - 3V_2 + 5V_3 - V_4$, Where V1, V2, V3 and V4 are inputs.	7	BTL 5	Evaluating	CO3
	(ii) Explain the application of op-amp as integrator.	6	BTL 4	Analyzing	CO3
17.	(i) For a max frequency of 100 Hz, Design a differentiator circuit and draw the frequency response for the same.	7	BTL 6	Creating	CO3
	(ii) What are the limitations of an ordinary op-amp differentiator? Modify the circuit of ordinary op-amp differentiator to obtain a practical differentiator that will eliminate these limitations.	6	BTL 6	Creating	CO3
PART – C					
1.	How will you design an inverting amplifier circuit for a gain of 10 also include necessary compensation circuitry for minimizing, input bias current, offset current and offset voltage.	15	BTL 5	Evaluating	CO3
2.	Determine the output voltage for the following circuits.  	7+ 8	BTL 5	Evaluating	CO3
3.	(i)Design a circuit to produce $V_0 = (V_3+V_4)–(V_1+V_2)$ using Op-Amp.	8	BTL 6	Creating	CO3
	(ii)Redraw the above designed circuit for $V_2=V_3=V_4$	7	BTL 6	Creating	CO3
4.	Drive and Explain the Second order Differential amplifier	15	BTL 5	Evaluating	CO3
5.	Create a double integrator circuit from single integrator circuit and explain its operation.	15	BTL 6	Creating	CO3

UNIT IV- APPLICATION OF OPAMPS

Instrumentation amplifiers, First-order and Second order active filters, V to I and I to V converters, Comparators and multi-vibrators, Waveform generators, Clippers and Clampers, Peak detector, D/A converters (Weighted resistance type and R- 2R ladder type), A/D converters (Flash type, Dual slope type and Successive Approximation types).

PART - A

Q. No	Questions	BT Level	Domain	COs
1.	Illustrate some of the important features of an instrumentation amplifier.	BTL 1	Remembering	CO4
2.	What are the basic requirements of a good instrumentation amplifier?	BTL 1	Remembering	CO4
3.	Summarize the applications of an instrumentation amplifier.	BTL 2	Understanding	CO4
4.	What is the need for converting a first order filter into a second order filter?	BTL 2	Understanding	CO4
5.	Enumerate the advantages & disadvantages of passive filters?	BTL 1	Remembering	CO4
6.	What is a V to I convertor?	BTL 1	Remembering	CO4
7.	What is an I to V convertor?	BTL 1	Remembering	CO4
8.	Analyze why active filters are preferred over passive filters?	BTL 4	Analyzing	CO4
9.	Define comparator and function of a phase shift circuit ?	BTL 1	Remembering	CO4
10.	Compose the applications of comparators.	BTL 6	Creating	CO4
11.	What is a Zero crossing detector?	BTL 1	Remembering	CO4
12.	Sketch the circuit of an op-amp employed as a non-inverting zero crossing detector, along with input and output waveforms.	BTL 3	Applying	CO4
13.	Summarize the difference between active clipper and passive clipper.	BTL 5	Evaluating	CO4
14.	Infer the advantage of using active clipper over passive clipper?	BTL 4	Analyzing	CO4
15.	Write any two applications of clipper and clamper.	BTL 1	Remembering	CO4
16.	Draw a peak detector circuit using op-amp. Give the applications of peak detectors	BTL 6	Creating	CO4
17.	What is sample and hold circuit? Point out where it is used? Why?	BTL 4	Analyzing	CO4
18.	Draw the diagram of sample and hold circuit.	BTL 2	Understanding	CO4
19.	List the types of DACs and ADCs.	BTL 1	Remembering	CO4
20.	Draw the diagram of R- 2R ladder type DAC.	BTL 2	Understanding	CO4
21.	Calculate the value of the LSB, MSB and full scale output for an 8 Bit DAC for the 0 to 12V range.	BTL 3	Applying	CO4
22.	Calculate the number of comparators required for realizing an 8 bit ADC.	BTL 3	Applying	CO4
23.	Draw the diagram of Successive Approximation types ADC.	BTL 2	Understanding	CO4
24.	Which is the fastest ADC? Why?	BTL 5	Evaluating	CO4

PART – B

1.	(i) With a suitable circuit diagram, explain the operating principle of an instrumentation amplifier and derive its gain.	7	BTL 2	Understanding	CO4
	(ii) Design a second order Butterworth low-pass filter having upper cut-off frequency of 2.1961 kHz.	6	BTL 6	Creating	CO4

2.	Draw and explain the circuit of a second order butterworth low pass filter and derive its transfer function.	13	BTL 6	Creating	CO4
3.	(i) Discuss about sample and hold circuit and explain its operation. (ii) Design a circuit of a clipper which will clip the input signal below a reference voltage.	7 6	BTL 2 BTL 6	Understanding Creating	CO4 CO4
4.	(i) What are the advantages of continuous type A/D converter over counter type A/D converter? (ii) Illustrate the working of successive approximation type A/D converter with a neat diagram.	3 10	BTL 3 BTL 5	Applying Evaluating	CO4 CO4
5.	(i) Sketch an instrumentation amplifier using 3 Op-Amp and derive its output voltage equation. (ii) Explain the first order low pass butterworth filter with neat diagram. Derive its frequency response and plot the same.	7 6	BTL 3 BTL 3	Applying Applying	CO4 CO4
6.	(i) Describe the second order high pass filter with its frequency response and design the circuit with the cut-off frequency of 5 KHz. (ii) With neat circuit diagram explain the working of Schmitt trigger using op-amp.	7 6	BTL 1 BTL 1	Remembering Remembering	CO4 CO4
7.	Explain the operation of multi-vibrators using Op-Amp.	13	BTL 4	Analyzing	CO4
8.	(i) Explain the application of Instrumentation for transducer bridge circuit. (ii) With neat circuit diagram, explain the operation of R-2R D/A converter.	7 6	BTL 1 BTL 1	Remembering Remembering	CO4 CO4
9.	Write a note on V to I and I to V converters using op-amp	13	BTL 3	Applying	CO4
10.	Analyze and design a RC phase shift oscillator for a frequency of 1 kHz.	13	BTL 4	Analyzing	CO4
11.	With neat sketch explain the working principle of Weighted resistor DAC using Op-Amp.	13	BTL 4	Analyzing	CO4
12.	(i) Explain the application of op-amp as clamper circuit. (ii) With neat sketch explain the operation of triangular waveform generator using op-amp.	7 6	BTL 4 BTL 4	Analyzing Analyzing	CO4 CO4
13.	(i) What is a comparator? With neat circuit diagram Explain its characteristics. (ii) Describe how an Op-Amp will be used as Peak detector.	7 6	BTL 1 BTL 1	Remembering Remembering	CO4 CO4
14.	(i) Explain the operation of dual slope ADC. (ii) Explain the following characteristics of ADC resolution, accuracy, settling time, linearity.	7 6	BTL 5 BTL 5	Evaluating Evaluating	CO4 CO4
15.	Explain the operation of following applications of operational amplifiers: (i) First order Band Pass Filter. (ii) Flash type A/D converter.	7 6	BTL 4 BTL 4	Analyzing Analyzing	CO4 CO4
16.	Derive the expression for the analog multiplier and divider with necessary diagrams.	13	BTL 1	Remembering	CO4
17.	Discuss multivibrators in detail with neat sketches.	13	BTL 2	Understanding	CO4
	PART – C				
1.	Construct an op-amp based instrumentation amplifier for industrial applications.	15	BTL 5	Evaluating	CO4

2.	(i) Design a second order butterworth low pass filter having upper cutoff frequency of 1kHz. (ii) Explain how to measure the phase difference between two signals.	10 5	BTL 6 BTL 6	Creating Creating	CO4 CO4
3.	Develop an op-amp based circuits to perform following mathematical operations: (i)Integration (ii)Logarithmic (iii)Multiplication	5 5 5	BTL 6 BTL 6 BTL 6	Creating Creating Creating	CO4 CO4 CO4
4.	Construct a First order High Pass Filter using IC 741 OpAmp. (Assume any cut off frequency of your choice) and explain its operation.	15	BTL 5	Evaluating	CO4
5.	Justify that how the circuit using Op-amps on the operation of. (i) Zero cross Detector, Clipper and Clamper circuit (ii) Schmitt Trigger.	8 7	BTL 5	Evaluating	CO4

UNIT V- SPECIAL ICS

555 Timer circuit: Functional block diagram, characteristics & applications –Astable and monostable multivibrator -566 Voltage Controlled Oscillator circuits - PLL Phase Locked Loop applications - Function generator circuit – Linear Voltage regulators.

PART - A

Q. No	Questions	BT Level	Domain	COs
1.	In what way VCO is different from other oscillators?	BTL 1	Remembering	CO5
2.	Point out any two application of 555 Timer in Mono stable mode.	BTL 4	Analyzing	CO5
3.	Define duty cycle in astable multivibrator using IC 555.	BTL 1	Remembering	CO5
4.	If the supply voltage (Vcc) to 555 timers is 10V, Evaluate the minimum and maximum value of the voltage across the capacitor connected to trigger input, when it is configured in Astable mode.	BTL 5	Evaluating	CO5
5.	Draw the Circuit Diagram of Astable multivibrator using 555 Timer IC.	BTL 2	Understanding	CO5
6.	Explain the different stages of operation in a PLL.	BTL 5	Evaluating	CO5
7.	Draw the Pin diagram of 566 VCO IC	BTL 2	Understanding	CO5
8.	Give the expression for the VCO free running frequency.	BTL 2	Understanding	CO5
9.	Analyze why VCO is called voltage to frequency converter?	BTL 4	Analyzing	CO5
10.	With reference to a VCO, summarize voltage to frequency conversion factor Kv.	BTL 6	Creating	CO5
11.	Define lock range and capture range with respect to PLL.	BTL 1	Remembering	CO5
12.	State why the phase detector output in a PLL should be followed by a low pass filter.	BTL 4	Analyzing	CO5
13.	Outline the applications of NE565.	BTL 3	Applying	CO5
14.	Draw the functional block of 555 timer IC.	BTL 3	Applying	CO5
15.	Define PLL.	BTL 1	Remembering	CO5
16.	What is Pull-in time?	BTL 1	Remembering	CO5
17.	List the applications of PLL.	BTL 2	Understanding	CO5
18.	Give the advantages of variable transconductance technique.	BTL 3	Applying	CO5
19.	A PLL frequency multiplier has an input frequency of ‘f’ and a decade counter is included in the loop. What will be the frequency of the PLL output?	BTL 1	Remembering	CO5
20.	Enlist the important features of 555 timer circuit.	BTL 6	Creating	CO5
21.	Draw the Circuit Diagram of monostable multivibrator using 555 Timer IC.	BTL 2	Understanding	CO5
22.	Draw the circuit diagram of a PLL circuit used as an AM modulator.	BTL 2	Understanding	CO5
23.	List the applications of Function generator.	BTL 2	Understanding	CO5
24.	What are the different types of Linear Voltage regulators?	BTL 1	Remembering	CO5

PART – B

1.	(i) Discuss the functional diagram of 555 timer and explain in detail.	7	BTL 2	Understanding	CO5
	(ii) Discuss the operation of PWM using 555 timer.	6	BTL 2	Understanding	CO5
2.	Explain with neat diagram of Astable multivibrator using 555 Timer IC.	13	BTL 4	Analyzing	CO5
3.	Explain with neat diagram of monostable multivibrator using 555 Timer IC.	13	BTL 4	Analyzing	CO5

4.	Describe the block diagram of a VCO and explain its operation.	13	BTL 2	Understanding	CO5
5.	With the help of schematic diagram, explain the operation of IC-566. Also derive an expression for the output frequency.	13	BTL 3	Applying	CO5
6.	(i) Design and draw the waveform of a 1kHz square wave generator using 555 timer for duty cycle of 50%. (ii) Explain the astable operation of IC555 with necessary waveforms.	4 9	BTL 6 BTL 6	Creating Creating	CO5 CO5
7.	(i) Evaluate the various phases in the operation of a PLL. (ii) In Astable multivibrator using 555 timer Ra=2.2Kohm, Rb=6.8Kohm and C=0.01microfarad. Calculate T_{high}, T_{low}, free running frequency and duty cycle.	7 6	BTL 5 BTL 5	Evaluating Evaluating	CO5 CO5
8.	Briefly explain the functional block diagram of NE565 PLL IC to operate as a frequency divider.	13	BTL 1	Remembering	CO5
9.	(i) For the astable circuit, derive the expression for high state time interval, low state time interval, period, frequency and duty cycle. (ii) Explain the operation of Function generator.	7 6	BTL 3 BTL 3	Applying Applying	CO5 CO5
10.	Explain the working of PLL using appropriate block diagram and analyze how it can be used as frequency translator.	13	BTL 4	Analyzing	CO5
11.	(i) Discuss the operation of a FSK generator using 555 timer. (ii) Describe any two applications of PLL.	7 6	BTL 1 BTL 1	Remembering Remembering	CO5 CO5
12.	Examine the operation of a free running oscillator and Monostable multivibrator using IC555 with necessary waveforms.	13	BTL 3	Applying	CO5
13.	Illustrate the operation of VCO with neat block diagram. Also derive an expression for f_0.	13	BTL 2	Understanding	CO5
14.	What is PLL? How frequency multiplication is done using PLL?	13	BTL 4	Analyzing	CO5
15.	(i) Explain functional block diagram of NE565 phase locked loop. (ii) Narrate the process of FSK demodulation using PLL.	7 6	BTL 2 BTL 2	Understanding Understanding	CO5 CO5
16.	Write short notes on (i) LM 317 Voltage Regulator. (ii) ICL 8038 Function Generator IC.	7 6	BTL 1 BTL 1	Remembering Remembering	CO5 CO5
17.	With block diagram explain the principle of operation of Linear voltage regulators	13	BTL 2	Understanding	CO5
PART – C					
1.	(i) Design a monostable multivibrator with pulse duration of 1ms using 555 timer IC. (ii) Briefly explain the difference between the two operating modes of 555 timer.	7 8	BTL 6 BTL 6	Creating Creating	CO5 CO5

2.	With neat figures design a PLL with free running frequency of 500KHz and the bandwidth of LPF is 50kHz. Will the loop acquire lock for an input signal of 600kHz. Justify your answer. Assume that phase detector needs to produce sum and difference frequency components.	15	BTL 5	Evaluating	CO5
3.	Design a frequency synthesizer circuit using PLL IC 565. Explain in detail about the operation and applications of it.	15	BTL 6	Creating	CO5
4.	(i) Discuss the basic analog multiplication techniques. (ii) Develop the expression for free running frequency of voltage-controlled oscillator.	7 8	BTL 6	Creating	CO5
5.	Draw the functional diagram of ICL 8038 function generator IC and Explain its operation.	15	BTL 5	Evaluating	CO5

Course Outcomes:

Cos	Course Outcome
CO1	Ability to understand the structure and underlying semiconductor physics concepts.
CO2	Ability to design circuits employing electronic devices.
CO3	Analyze, comprehend and design of analog electronic circuits involving OPAMP.
CO4	Analyze, comprehend and design of analog electronic circuits involving timer 555.
CO5	Analyze, comprehend and design of analog electronic circuits involving PLL, voltage regulator & other specializes.