QUESTION BANK

SUBJECT : EC8453 - LINEAR INTEGRATED CIRCUITS

SEMESTER/YEAR : IV /II

Unit I - BASICS OF OPERATIONAL AMPLIFIERS			
Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – JFET Operational Amplifiers – LF155 and TL082.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Mention the importance of offset voltage of an operational amplifier?	BTL 1	Remembering
2.	Define CMRR.	BTL 1	Remembering
3.	Outline the importance of current mirror circuit used in differential amplifier stages.	BTL 2	Understanding
4.	Specify the ideal characteristics of Op-amp and methods can be used to produce voltage sources.	BTL 1	Remembering
5.	How will you understanding the term 'thermal drift' ?	BTL 1	Remembering
6.	Explain about current mirror with magnification.	BTL 1	Remembering
7.	Define slew rate and what causes the slew rate?	BTL 1	Remembering
8.	State loading effect? How can you reduce it?	BTL 2	Understanding
9.	Why do we use R_{comp} resistor?	BTL 2	Understanding
10.	What is the gain cross over and phase cross over frequencies?	BTL 2	Understanding
11.	Categorize the characteristics of Non-ideal op-amp.	BTL 3	Applying
12.	Develop the internal block diagram of an Op-amp.	BTL 3	Applying
13.	Illustrate the pin diagram of IC 741.	BTL 3	Applying
14.	Examine the importance of input off set current.	BTL 4	Analyzing
15.	Analyze about input bias current.	BTL 4	Analyzing

16.	Inspect the draw backs of using large R_C in differential amplifier.		BTL 4	Analyzing
17.	Brief the necessity of active loads preferred than passive loads in the input stage of an operational amplifier.		BTL 5	Evaluating
18.	Justify that, why IC741 op-amp not used for high frequency applications?		BTL 5	Evaluating
19.	Calculate the maximum distorted amplitude that a sine wave input of 10 kHz, can produce at the output of an op-amp whose slew-rate is 0.5v/μsec.		BTL 6	Creating
20.	A Differential amplifier has a differential voltage gain of 2000 and common mode gain of 0.2. Determine CMRR.		BTL 6	Creating
	PART – B			
1.	Define and explain slew rate. Derive its equation. Also explain method adapted to improving slew rate.	(13)	BTL 1	Remembering
2.	(i) Write down the characteristics and their respective values of an ideal operational amplifier. (ii) Draw the circuit of basic current mirror and explain its operation.	(6) (7)	BTL 1	Remembering
3.	(i) Describe about output offset voltage. Explain methods to nullify offset voltage. (ii) With neat circuit diagram, explain the operation of voltage reference circuit using temperature compensation.	(7) (6)	BTL 1	Remembering
4.	(i) Discuss on current mirror with magnification. (ii) Use appropriate block diagram, explain the general stages of an Op-Amp IC.	(6) (7)	BTL 2	Understanding
5.	(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 2	Understanding
6.	(i) Draw the circuit of basic current mirror and explain its operation. (ii) Give the detail of the DC analysis of a basic differential amplifier with necessary diagram.	(6) (7)	BTL 3	Applying
7.	Obtain the expression for differential gain, common mode gain, CMRR, R_I and R_O of an emitter coupled differential amplifier.	(13)	BTL 4	Analyzing
8.	(i) Sketch the Wilson current source and write short note about it. (ii) Using suitable diagram and necessary equations, explain the concept of Widlar current source used in op-amp circuit.	(5) (8)	BTL 3 BTL 4	Applying Analyzing
9.	Show the transfer characteristics of dual input differential amplifier showing the linear and limiting regions. Comment on the same.	(13)	BTL 4	Understanding
10.	(i) Derive the functional parameters for an inverting mode negative feedback gain circuit with a 741op-amp in IC inverting mode, with R1=1Kohm, Rf=40Kohm and compute Af, Rif, Rof, BW, offset voltage. (ii) Discuss briefly on the differential mode Instrumentation amplifier.	(7) (6)	BTL 4 BTL 3	Analyzing Applying
11.	Examine the working principle of BJT differential amplifier with active load.	(13)	BTL 5	Evaluating

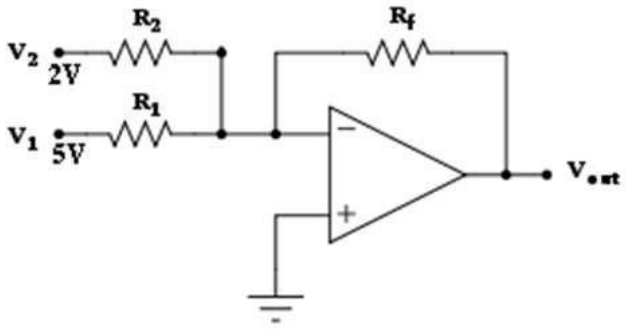
12.	(i) Compose the concept of Widlar current source used in op-amp circuit With suitable circuit diagram and necessary equations. (ii) Justify the preference of active load over passive load.	(10) (3)	BTL 6	Creating
13.	Write note on LF155 JFET input operational amplifier and TL082 wide bandwidth dual JFET input operational amplifier with necessary diagram.	(13)	BTL 1	Remembering
14.	State and explain about CMRR, A_d, A_c and suggest a method to improve CMRR.	(13)	BTL 4	Analyzing
	PART – C			
1.	Derive the transfer characteristics of dual input differential amplifier showing the linear and limiting regions. Comment on the same.	(15)	BTL 5	Evaluating
2.	(i) A square wave peak-to-peak amplitude of 50mV has to be amplified to a peak-to-peak amplitude of 3V, with rise time of 4 μs or less. Can IC741 be used? (ii) A IC741 Op-Amp whose slew rate is 0.5V/μs is used as an inverting amplifier with a gain of 50.The voltage gain Vs frequency curve of IC741 is flat up to 20 kHz. What maximum peak to peak input signal can be applied without distorting the output?	(5) (10)	BTL 6	Creating
3.	Explain in detail the A.C analysis of dual input, balanced output differential amplifier or derive the expression for differential gain, common mode gain, CMRR, R_I and R_O of an emitter coupled differential amplifier.	(15)	BTL 5	Evaluating
4.	(i) Assuming slew rate for 741 is 0.5 V/μs, what is the maximum undistorted sine wave that can be obtained for (a) 12 V Peak to Peak. (b) 2 V Peak to Peak. (ii) An inverting amplifier using the 741C must have a flat response up to 40 kHz. The gain of the amplifier is 10. What maximum peak-to-peak input signal can be applied without distortion the output	(8) (7)	BTL 6	Creating

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

PART – A

Q.No	Questions	BT Level	Competence
1.	Mention the advantages of variable trans conductance technique?	BTL 2	Understanding
2.	Summarize the other name for Clipper circuit?	BTL 2	Understanding
3.	What is the need for converting a first order filter into a second order filter?	BTL 2	Understanding
4.	How is the current characteristic of a PN junction employed in a log amplifier?	BTL 1	Remembering
5.	Compare the performance of inverting and non-inverting operational amplifier configurations.	BTL 4	Analyzing
6.	Give the applications of inverting & non- inverting amplifiers.	BTL 1	Remembering
7.	Draw the inverting & non- inverting amplifiers with appropriate equations.	BTL 3	Applying
8.	List the applications for each of the following circuits: Voltage follower, Peak detector, Schmitt trigger, Clamper.	BTL 2	Understanding
9.	Why integrators are preferred over differentiators in analog computers?	BTL 5	Evaluating

10.	Summarize the frequency expressions for LPF, HPF and BPF.		BTL 1	Remembering
11.	Enumerate the advantages & disadvantages of passive filters?		BTL 1	Remembering
12.	Sketch the opamp integrator & differentiator circuit with necessary equation.		BTL 3	Applying
13.	Define comparator and function of a phase shift circuit ?		BTL 1	Remembering
14.	Give some important features of an instrumentation amplifier.		BTL 1	Remembering
15.	Construct an adder circuit using op-amp to get the output expression as Vo = -(0.1V1 +V2+5V3)		BTL 3	Applying
16.	Demonstrate the need for frequency compensation in practical op-amps		BTL 4	Analyzing
17.	Show the necessity of active guard drive in an instrumentation amplifier.		BTL 4	Analyzing
18.	Find the output voltage of the following circuit. Given R1 =R2 = 10kΩ and Rf = 100  		BTL 6	Creating
19.	How does precision rectifier differ from the conventional rectifier?		BTL 5	Evaluating
20.	Design an amplifier with a gain of -10 and input resistance equal to 10 kΩ.		BTL 6	Creating
	PART – B			
1.	(i). With a suitable circuit diagram, explain the operating principle of an instrumentation amplifier and derive its gain. (ii). Design a second order Butterworth low-pass filter having upper cut-off frequency of 2.1961 kHz	(7) (6)	BTL 2	Understanding
2.	Compare and contrast Adder, Subtractor, and Averaging circuit using op-amp with equations.	(13)	BTL 4	Analyzing
3.	Write the operation of current to voltage and Voltage to current converter circuits.	(13)	BTL 1	Remembering
4.	(i) Draw and explain the operation of Triangular wave generator. (ii)Write short notes on second order Low Pass Butterworth filter (Sallen-key filter).	(5) (8)	BTL 1 BTL 1	Remembering Remembering
5.	Derive the expression for log computation using op-amp and explain necessary circuit diagram.	(13)	BTL 5	Evaluating
6.	With neat figures describe the circuit using op-amps on the following of (i). Integrator and double integrator circuit. (ii). First order High pass filter	 (7) (6)	BTL 1	Remembering
7.	Draw and explain the circuit of a voltage to current converter if the load is i) Floating ii) Grounded	 (7) (6)	BTL 1	Remembering
8.	(i) Design an OP-AMP based first order active low pass filter. (ii) Create if a bandpass filter has a lower cut-off frequency f_L=250Hz and a higher cut-off frequency f_H = 2500Hz the find its bandwidth and the resonant frequency.	(7) (6)	BTL 6	Creating
9.	i) Analyze the distinct features of the precision diode. ii) Using appropriate equations discuss about the working of Half wave Precision Rectifier.	(3) (10)	BTL 4 BTL3	Analyzing Applying
10.	(i). With neat sketch explain the working of Full wave Precision Rectifier in detail. (ii). Sketch the Integrator circuit and explain the working principle in	(8) (5)	BTL 3	Applying

	detail.			
11.	i) Explain With neat diagram and operation of Schmitt trigger. ii) Summarize a detailed note about op-amp band pass filter.	(5) (8)	BTL 2	Understanding
12.	Conclude that how antilog computations are performed using IC-741 explain using circuits and necessary equations.	(13)	BTL 5	Evaluating
13.	(i). Examine the principal of operation of Voltage follower with the neat circuit diagram and mathematical expressions. (ii). With the neat circuit diagram and mathematical expressions, explain the operation of Scale changer.	(6) (7)	BTL 4 BTL 3	Analyzing Applying
14.	Discuss wave shaping circuits using operational amplifier.	(13)	BTL 2	Understanding
	PART – C			
1.	Evaluate Inverting adder and Non-inverting adder with neat circuit diagram and mathematical expressions. (15)		BTL 5	Evaluating
2.	Design a differentiator using Op-Amp to differentiate an input signal with f_{max} = 200 Hz and also draw the output waveforms for a sine-wave and square-wave input of 1V peak at 200 Hz. (15)		BTL 6	Creating
3.	Given a bandpass filter with resonant frequency f_r of 1000Hz and a bandwidth (BW) of 3000Hz, find its. (a). Quality factor. (b). Lower Cut-off frequency. (c). High Cut-off Frequency		BTL 6	Creating
4.	Using Op-amps circuit examine the operation of. (i) Zero cross Detector, Clipper and Clamper circuit (8) (ii) Scmitt Trigger. (7)		BTL 5	Evaluating

UNIT III ANALOG MULTIPLIER AND PLL

Analog Multiplier using Emitter Coupled Transistor Pair Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing, Clock synchronization

PART A

Q.No	Questions	BT Level	Competence
1.	Outline the basic building blocks of PLL.	BTL 1	Remembering
2.	Define capture range and lock range of PLL.	BTL 1	Remembering
3.	What is Pull- in time?	BTL 1	Remembering
4.	For perfect lock, what should be the phase relation between the incoming signal and VCO output signal?	BTL 4	Analyzing
5.	Mention the classification of phase detector. Write about switch type phase detector.	BTL 2	Understanding

6.	Illustrate the problems associated with switch type phase detector	BTL 2	Understanding
7.	Why VCO is also called as V to F converter?	BTL 1	Remembering
8.	On what parameters does the free running frequency of VCO depend on?	BTL 3	Applying
9.	Give the expression for the VCO free running frequency.	BTL 2	Understanding
10.	Demonstrate Voltage to Frequency conversion factor.	BTL 2	Understanding
11.	Describe the purpose of having a low pass filter in PLL.	BTL 3	Applying
12.	Discuss the effect of having large capture range.	BTL 6	Creating
13.	Estimate that the frequency stability obtained in a PLL by use of VCO.	BTL 5	Evaluating
14.	How are square root and square of a signal obtained with multiplier circuit?	BTL 1	Remembering
15.	Identify the merits of companding	BTL 3	Applying
16.	List out the applications of OTA.	BTL 1	Remembering
17.	Asses the need of pre-distortion circuits in Gilbert analog multiplier and how is the configuration of Gilbert multiplier done with pre-distortion circuits.	BTL 5	Evaluating
18.	Analyze the necessity of modulation.	BTL 4	Analyzing
19.	Develop the circuit of AM detector using PLL.	BTL 6	Creating
20.	Distinguish the advantages & disadvantages of monolithic PLLs over Discrete PLLs.	BTL 4	Analyzing
	PART – B		
1.	How would you describe the block diagram of PLL and derive the expression for Lock range and capture range. (13)	BTL 1	Remembering
2.	Illustrate the operation of VCO with neat block diagram. Also derive an expression for f_0. (13)	BTL 2	Understanding
3.	(i) Analyze the Gilbert's four quadrant multiplier cell with a neat circuit diagram. (8) (ii) Identify how a frequency doubler can be realized using this cell. (5)	BTL 4 BTL 3	Analyzing Applying
4.	Discuss any three applications of PLL in detail. (13)	BTL 6	Creating
5.	Explain the purpose and functioning of (i) Frequency division circuit using PLL IC565 (7) (ii) Frequency synthesizer (6)	BTL 2	Understanding
6.	(i) Estimate the working principle of operational Transconductance Amplifier (OTA). (8) (ii) Explain the application of VCO for FM generation. (5)	BTL 3	Applying
7.	(i). Define capture range and lock range. (3) (ii). Explain the process of capturing the lock and also derive for capture range and lock range. (10)	BTL 1	Remembering
8.	(i) How would you explain the working of a VCO? (6) (ii) Derive the expression for voltage to frequency conversion factor. (7)	BTL 1	Remembering
9.	Determine how the IC 565 PLL can be used as a Frequency multiplier/divider. (13)	BTL 5	Evaluating

10.	(i) Examine the multiplier cell using emitter- coupled transistor pair. (8) (ii) Analyze that the output voltage is proportional to the product of the two input voltages and state their limitations. (5)	BTL 4	Analyzing
11.	Briefly explain the use of PLL for FM detection and the process of FSK demodulation. (13)	BTL 1	Remembering
12.	Discuss the following applications of Analog Multiplier ICs (i) Voltage squarer (3) (ii) voltage divider (4) (iii) square rooter (3) (iv) Phase angle detector (3)	BTL 2	Understanding
13.	Measure the closed loop analysis of PLL with necessary diagrams. (13)	BTL 4	Analyzing
14.	Explain the operation of a variable trans conductance multiplier circuit. Derive the expression for its output voltage. (13)	BTL 4	Analyzing
	PART - C		
1.	(i). Discuss the basic analog multiplication techniques. (7) (ii). Develop the expression for free running frequency of voltage controlled oscillator. (8)	BTL 6	Creating
2.	(i). Determine the output frequency f_0, lock range Δf_L and capture range Δf_C of IC 565. Assume R_1=15K C_1=0.01µF, C=1µF and the supply voltage is +12V. (9) (ii). A PLL IC connected as an FM demodulator R_1 = 10KΩ C_1 =0.04 µF. The supply voltage is +12 V. Determine (a) free-running frequency. (b) Lock-range and (c). Capture range. (6)	BTL 5	Evaluating
3.	(i). For PLL 565, given the free-running frequency as 100KHz, the demodulation capacitor of 2µf and supply voltage is ±6V, determine the lock and capture frequencies and identify the component values. (10) (ii) Determine the change in dc controlled voltage v_c during lock, if input signal frequency f_s = 20kHz, the free running frequency is 21 kHz and the V/F transfer coefficient of VOC is 4kHz/V. (5)	BTL 5	Evaluating
4.	Construct the block diagram and explain principle of working, characteristics and applications of: (i) Frequency synthesizer. (8) (ii) Frequency shift keying (FSK) Demodulator (7)	BTL 6	Creating

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

Analog and Digital Data Conversions, D/A converter – specifications weighted resistor type, R- 2R Ladder type, Voltage Mode and Current- Mode R - 2R Ladder types - switches for D/A converters, high speed sample- and- hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage- to- Time Conversion - Over- sampling A/D Converters, Sigma- Delta converters

PART A

Q. No	Questions	BT Level	Competence
1.	Classify the A/D converters based on their operational features.	BTL 2	Understanding
2.	List the direct type ADCs.	BTL 4	Analyzing
3.	What is the function of integrating type converter? List out some integrating type converters.	BTL 1	Remembering
4.	Review the principle of operation of successive Approximation ADC.	BTL 2	Understanding
5.	Mention the main advantages of integrating type ADCs.	BTL 1	Remembering
6.	Define Sampling .	BTL 1	Remembering
7.	Compare the advantages and drawbacks of a dual- slop ADC.	BTL 2	Understanding
8.	Distinguish between conversion time and settling time.	BTL 4	Analyzing
9.	Find the number of resistors required for an 8-bit weighted resistor D/A converter. Consider the smallest resistance is R and obtain those resistance values.	BTL 5	Evaluating
10.	Give the advantages of inverted R-2R (current type) ladder D?A converter over R -2R(voltage type) D/A converter ?	BTL 1	Remembering
11.	Brief the need for electronic switches in D/A converter and mention the names of the switches used in MOS transistors.	BTL 1	Remembering
12.	Summarize delta modulation.	BTL 2	Understanding
13.	How would you justify which type of ADC is the fastest?	BTL 5	Evaluating
14.	Outline the principle of operation of voltage to time conversion.	BTL 1	Remembering
15.	Calculate the values of LSB and MSB for an 8- bit DAC for 0V to 10V range.	BTL 6	Creating
16.	Interpret the features of granular error and slope overload error.	BTL 3	Applying
17.	An 8 bit A/D converter accepts an input voltage signal of range 0 to 12v. What is the digital output for an input voltage of 6V?	BTL 3	Applying
18.	Evaluate the number of comparators required for realizing a 4-bit flash ADC.	BTL 6	Creating
19.	Compare and contrast binary weighted and R- 2R ladder DAC.	BTL 4	Analyzing
20.	Identify the need of Sample and hold circuit and Why schottky diodes are used in sample and hold circuits?	BTL 3	Applying

PART – B

1.	(i) (ii)	How would you categorize A/D converters? Discuss the working principle of successive approximation type ADC.	(6) (7)	BTL 2	Understanding
2.	(i) (ii)	Estimate the working of R- 2R ladder type DAC. Compare binary weighted DAC with R- 2R ladder network DAC.	(7) (6)	BTL 4	Analyzing
3.	(i) (ii)	With circuit schematic explain analog switches using FET. What is meant by resolution, offset error in ADC.	(7) (6)	BTL 1	Remembering
4.	(i) (ii)	Explain in detail on the operational features of 4-bit weighted resistor type D/A converter. Differentiate between current mode and voltage mode R-2R ladder D/A converters.	(7) (6)	BTL 4	Analyzing

5.		Describe the operation of any two direct type of ADCs and Explain.	(13)	BTL 1	Remembering
6.		Summarize the following Digital to Analog & Analog to Digital conversion techniques. (i) Flash type ADC. (ii) Weighted resistor DAC.	 (7) (6)	BTL 2	Understanding
7.	(i) (ii)	Draw the diagram of sample and hold circuit. State how you will reduce its hold mode droop.	(6) (7)	BTL 1	Remembering
8.		Design a 4–bit binary weighted resistor DAC for the following specifications: Use LM741 op- amp, R = 10kΩ, V_{ref} =2.5V and full scale output = 5V**.**	(13)	BTL 4	Analyzing
9.		A dual slope ADC has a full scale input of 2 Volts .It uses an integrating time of 10ms and integrating capacitor of 0.1µf.the maximum magnitude of the integrator output should not exceed 3V. Calculate the value of the integrating resistor**.**	(13)	BTL 3	Applying
10.		Describe in detail about the single slope type ADC with neat sketch.	(13)	BTL 3	Applying
11.	(i) (ii)	Sketch the block diagram and explain the working of Charge Balancing VFCS With functional block diagram explain A/D converter using Voltage to Time converter with input and output waveforms.	(6) (7)	BTL 1	Remembering
12.	(i) (ii)	Elaborate the operation of high speed sample and hold circuits. Develop a system employs a 16-bit word for representing the input signal. If the maximum output voltage is set 2V, calculate the resolution of the system and its dynamic range.	(9) (4)	BTL 6	Creating
13.	(i) (ii)	Illustrate the various important specifications of both D/A and A/D converters generally specified by the manufactures are analysed. A 8-bit A/D converter accepts an input voltage signal of range 0 to 9V, What is the minimum value of the input voltage required for generating a change of 1 least significant bit ? specify the digital output for an input voltage of 4 V. What input voltage will generate all 1s at the A/D converter output?	(7) (6)	BTL 2	Understanding
14.	(i) (ii) (iii)	The basic step of a 9-bit DAC is 10.3mV. If 000000000 represents 0V, what output is produced if the input is 101101111? Calculate the values of the LSB, MSB and full scale output for an 8-bit DAC for the 0 to 10V range. What output voltage would be produced by a D/A converter whose output range is 0 to 10V and whose input binary number is (i) 10 (for a 2-bit D/A converter) (ii) 0110 (for a 4-bit DAC) (iii) 10111100 (for a 8-bit DAC)	(3) (5) (5)	BTL 5	Evaluating
PART - C					

1.	(i) (ii)	For a 4-bit R-2R ladder D/A converter assume that the full scale voltage is 16V.Calculate the step change in output voltage on input varying from 01111 to 1111. Discuss the important specification of Data Converters.	(10) (5)	BTL6	Creating
2.	(i) (ii) (iii))	Compare single slope ADC and dual slope ADC. Draw the circuit and explain the working of dual slope A/D converter. Calculate t_2 for a particular dual slope ADC, t_1 is 83.33ms and the reference voltage is 100mv if 1. V_1 is 100 mv and 2. 200 mv	(3) (7) (5)	BTL 5	Evaluating
3.	Design the R-2R 4-bit converter and assume that feedback resistance R_f of the op-amp is variable, the resistance R=10kΩ and V_R =10V. Determine the value of R_f that should be connected to achieve the following output conditions. (i) The value of 1 LSB at the output is 0.5V (ii) An analog output of 6V for a binary input of 1000. (iii) The Full-scale output voltage of 12V (iv) The actual maximum output voltage of 10V		(15)	BTL 6	Creating
4.	(i) (ii)	Derive the Inverted or Current mode R-2R Ladder Digital to analog converter and explain. Examine the inverted R-2R ladder (refer above question) has R=Rf=10kΩ and V_R=10V. Calculate the total current delivered to the op-amp and the output voltage when the binary input is 1110.	(10) (5)	BTL 5	Evaluating

UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – out(LDO) Regulators -Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

PART A

Q. No	Questions	BT Level	Competence
1.	What is the need for voltage regulator ICs?	BTL 2	Understanding
2.	List the characteristics and applications of Opto coupler.	BTL 4	Analyzing
3.	Sketch a fixed voltage regulator circuit and state its operation.	BTL 1	Remembering
4.	Mention the conditions for oscillation.	BTL 2	Understanding
5.	What is a switching regulator?	BTL 1	Remembering
6.	List the applications of 555 timer in Monostable mode of operation.	BTL 1	Remembering
7.	Classify the three different wave forms generated by ICL8038.	BTL 2	Understanding
8.	Mention the need for current limiting in voltage regulators.	BTL 4	Analyzing
9.	Compare Linear regulator and Switched mode regulator.	BTL 5	Evaluating

10.		Mention the function of a voltage regulator .Give some examples of monolithic IC voltage regulators.		BTL 1	Remembering
11.		Draw the functional block diagram of IC 723 regulator.		BTL 1	Remembering
12.		Compare the principle of linear regulator and a switched mode power supply.		BTL 2	Understanding
13.		How would you classify an opto-coupler , also mention the current transfer ratio of an opto coupler.		BTL 5	Evaluating
14.		Define line and load regulation of a regulator.		BTL 1	Remembering
15.		In a Astable multivibrator of 555 times R_A=606kΩ and C=0.1μF. Calculate (a) t_{HIGH} (b)t_{LOW} (c) free running frequency (d) duty cycle (D).		BTL 6	Creating
16.		How does switched capacitor emulate resistor?		BTL 3	Applying
17.		With reference to a VCO, define voltage to frequency conversion factor K_v.		BTL 3	Applying
18.		In a monostable multivibrator using 555 timer, R=100kΩ and the time delay is 100ms.Find the value of C.		BTL 6	Creating
19.		List the types of Multivibrator.		BTL 4	Analyzing
20.		Give reasons for the purpose of connecting a capacitor at the input and output side of an IC voltage regulator?		BTL 3	Applying
		PART – B			
1.		Write a short notes on (i) Opto couplers. (ii) Switched capacitor filter (iii)Audio power amplifier	 (5) (4) (4)	BTL 2	Understanding
2.	(i) (ii)	Demonstrate and explain the functional diagram of LM 380 power amplifier. Illustrate the essential characteristics of power amplifier.	(8) (5)	BTL 2	Understanding
3.	(i) (ii)	What is 555 timer? Explain the working of 555 timer as Monostable Multivibrator. Derive an expression for the frequency of oscillation with relevant waveforms.	(7) (6)	BTL 1	Remembering
4.	(i) (ii)	Analyze and explain the operation of switching regulator with neat diagram. Examine the operation of frequency to voltage converters.	(8) (5)	BTL 4	Analyzing
5.	(i) (ii)	Show the working of Astable Multivibrator using op-amp. Outline any one application of Astable Multivibrator in detail.	(8) (5)	BTL 1	Remembering
6.	(i) (ii)	Design a phase shift oscillator to oscillate at 100 Hz. Design a frequency to voltage converter using IC VFC 32 for a full scale output of 8V for a full scale input frequency of 80kHz with a maximum ripple of 8mV.	(6) (7)	BTL 6	Creating
7.	(i) (ii)	Define voltage regulator and explain the working of Linear Voltage regulator with neat circuit diagram using op-amps. List any two important features of linear voltage regulator IC723.	(8) (5)	BTL 1	Remembering
8.	(i) (ii)	Assess the working principle of monolithic switching regulator.	(8) (5)	BTL 5	Evaluating

		Evaluate how the frequency is computed using voltage to frequency converter.			
9.	(i) (ii)	With neat diagram, explain the operation of an astable and monostable multivibrators using opamp. Illustrate the functional diagram and connection diagram of a low voltage regulator and explain.	(8) (5)	BTL 3	Applying
10.	(i) (ii)	Develop the basic principle of function generator? Draw the schematic of ICL 8038 function generator and discuss its features. Solve the expression for the frequency of a triangular waveform generator and explain the circuit.	(7) (6)	BTL3	Applying
11.	(i) (ii)	Describe the 555 timer IC.design a astable multivibrator circuit to generate output pulses of 25%,50% duty cycle using a 555 timer IC with the choice of C=0.01μF and a frequency of 4 kHz. Demonstrate Monostable multivibrator with necessary diagrams and derive for ON time and recovery time.	(6) (7)	BTL 2	Understanding
12.	(i) (ii)	Interpret the working of monostable multivibrator. What are opto-couplers?	(10) (3)	BTL 1	Remembering
13.	(i) (ii)	Analyzing the working of a general purpose voltage regulator. Justify the need for isolation amplifiers.	(10) (3)	BTL 4	Analyzing
14.	With a neat circuit diagram, explain the working of linear voltage regulator using operational amplifier.		(13)	BTL 4	Analyzing
		PART C			
Q. No	Questions			BT Level	Competence
1.	(i) (ii)	In a astable multivibrator using 555 timer Ra=6.8K,Rb = 3.3K, C=0.1uF.Calculate the free running frequency. Design a square wave generator using 555timer for a frequency of 120Hz and 60% duty cycle. Assume C=0.2uF.	(8) (7)	BTL 5	Evaluating
2.	(i) (ii)	Analyze the important features and pin details of switched capacitor filter IC MF10. Design a wave generator using 555 timer for a frequency of 110Hz and 80 % duty cycle. Assume C =0.12μF	(8) (7)	BTL 6	Creating
3.	Derive the expression and circuit operation for LM 380 Audio power amplifier.		(15)	BTL 5	Evaluating
4.	Design an adjustable voltage regulator circuit using LM 317 for the following specifications: Input dc voltage =13.5 V; Output dc voltage = 5 to 9V; Load current (maximum) = 1A.		(15)	BTL 6	Creating