SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT
OF
ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

IV SEMESTER

1907403 – LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

Regulation – 2019

Academic Year: 2022-2023 (EVEN)

Prepared by

Mr.B.Parameswaran,
Assistant Professor / EIE

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

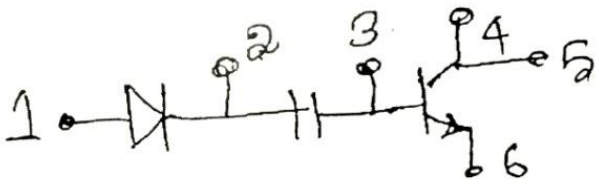
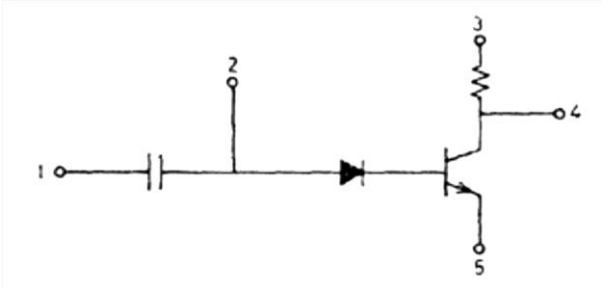
SRM Nagar, Kattankulathur – 603 203.

DEPARTMENT OF ELECTRONICS AND NSTRUMENTATION ENGINEERING

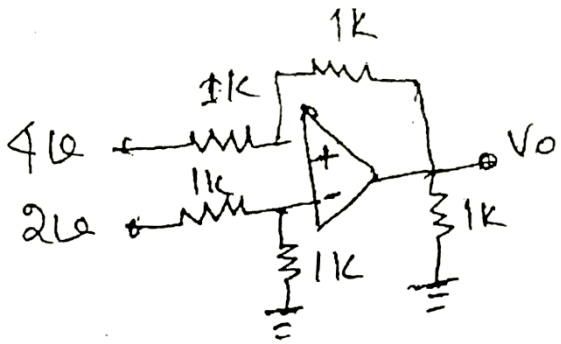
QUESTION BANK

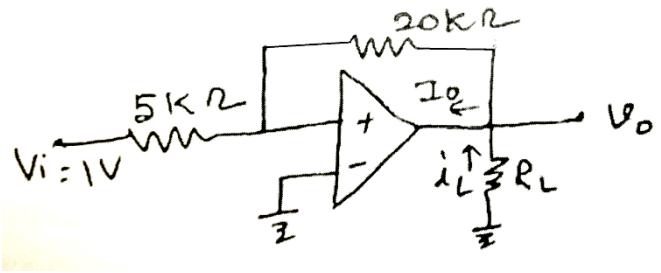
SUBJECT : 1907403 –Linear Integrated Circuits and Applications
SEM / YEAR: IV / II

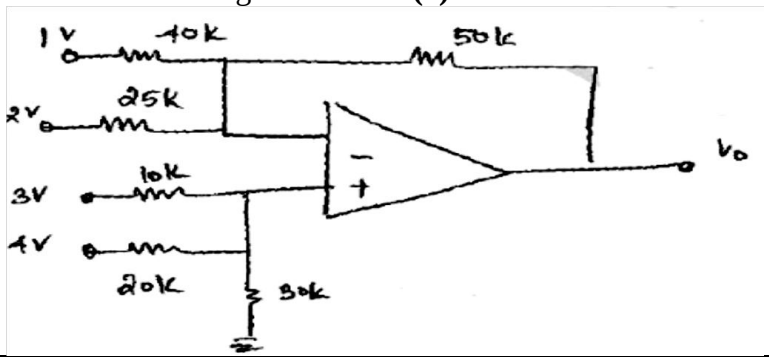
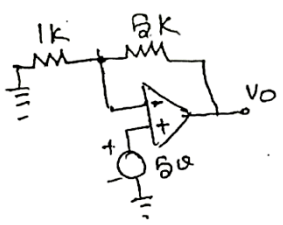
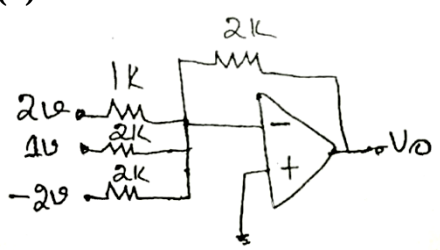
UNIT I - IC FABRICATION			
IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Give the difference between monolithic and hybrid ICs.	**BTL-2**	**Understand**
2.	Classify ICs on the basis of application, device used and chip complexity.	**BTL-3**	**Apply**
3.	State the limitations of IC technology.	**BTL-1**	**Remember**
4.	List the advantages of integrated circuits over discrete component circuits.	**BTL-1**	**Remember**
5.	Distinguish between dry etching and wet etching.	**BTL-2**	**Understand**
6.	What is the purpose of oxidation process in IC Fabrication?	**BTL-2**	**Apply**
7.	List the steps used for preparation of silicon wafer.	**BTL-4**	**Analyze**
8.	What is meant by ion implantation? Give its advantages.	**BTL-1**	**Remember**
9.	State the advantages of CMOS circuits.	**BTL-1**	**Remember**
10.	List the basic process used in IC fabrication.	**BTL-1**	**Remember**
11.	Define the term photolithography in IC fabrication.	**BTL-1**	**Remember**
12.	Summarize the popular IC package configurations available.	**BTL-5**	**Evaluate**
13.	Examine dielectric isolation in IC Fabrication. Mention its application and Limitations.	**BTL-3**	**Apply**
14.	How surface layer of SiO2 is formed?	**BTL-6**	**Apply**
15.	Summarize the purpose and relative merits of PV cell.	**BTL-5**	**Evaluate**
16.	Analyze the need for buried layer in fabrication of monolithic integrated transistor.	**BTL-4**	**Analyze**
17.	Differentiate between thin film and thick film technology in IC fabrication.	**BTL-2**	**Understand**
18.	Justify the importance of epitaxial growth.	**BTL-6**	**Apply**
19.	Compare the performance of n-p-n and p-n-p transistors with respect to IC fabrication.	**BTL-4**	**Analyze**
20.	Relate the advantages of polysilicon gate MOSFET over aluminium gate.	**BTL-3**	**Apply**
21.	Why aluminium is preferred in metallization process?	**BTL-3**	**Apply**
22.	Name the parameters which govern the thickness of the film in the oxidation process.	**BTL-2**	**Understand**
23.	What is the difference between diffusion and ion implantation?	**BTL-4**	**Analyze**
24.	Why inductors are difficult to fabricate in integrated circuits?	**BTL-5**	**Evaluate**
PART – B			

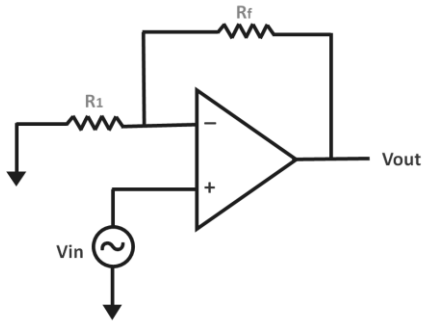
1.	Construct a typical transistor from the fabrication techniques of monolithic ICs and briefly explain the process involved in it.**(13)**	**BTL-6**	**Create**
2.	**(i)** What is thin and thick film technology?**(3)** **(ii)** Describe the various methods used for deposition of thin film technology. **(10)**	**BTL-1**	**Remember**
3.	Discuss in detail about diffusion and ion implantation process in IC fabrication. **(13)**	**BTL-1**	**Remember**
4.	Discuss in detail about the fabrication of the following **(i)** PN junction diode **(7)** **(ii)** JFET **(6)**	**BTL-2**	**Understand**
5.	**(i)** Write a note on classification of IC. **(7)** **(ii)** Explain the different types of IC packages.**(6)**	**BTL-1**	**Remember**
6.	Briefly describe the various processes involved in fabrication of monolithic IC which integrates diode, capacitance and FET.**(13)**	**BTL-2**	**Understand**
7.	How the process of masking and photo etching done in IC fabrication. **(13)**	**BTL-5**	**Evaluate**
8.	With neat illustrations explain the various steps involved in the fabrication of PV Cell.**(13)**	**BTL-3**	**Apply**
9.	With circuit diagram explain the steps involved in the fabrication of the circuit shown below using IC technology.**(13)** 	**BTL-4**	**Analyze**
10.	Describe photolithography process with neat diagram. **(13)**	**BTL-1**	**Remember**
11.	Describe about the basic process used in silicon planar technology with neat diagram. **(13)**	**BTL-2**	**Understand**
12.	Elaborate the fabrication of MOS ICs with suitable diagram. **(13)**	**BTL-1**	**Remember**
13.	Describe the steps involved in the fabrication of monolithic IC transistors.**(13)** 	**BTL-4**	**Analyze**
14.	With neat illustrations explain the various steps involved in the IC fabrication process.**(13)**	**BTL-3**	**Apply**
15.	Elaborate the CMOS technology with necessary diagram.**(13)**	**BTL-2**	**Understand**
16.	Describe the metallization process, assembly processing and packaging with neat diagram. **(13)**	**BTL-5**	**Evaluate**
17.	Explain how epitaxial layer is grown during IC fabrication. **(13)**	**BTL-3**	**Apply**

PART – C			
1.	Mention the importance of Czochralski process in silicon ingot preparation.**(15)**	**BTL-5**	**Evaluate**
2.	Write a note on recent fabrication methods of diode and capacitance for industrial applications.**(15)**	**BTL-5**	**Evaluate**
3.	Write a note on recent fabrication methods of FET for industrial applications.**(15)**	**BTL-5**	**Evaluate**
4.	Evaluate the different methods of fabricating the integrated resistor with neat diagram.**(15)**	**BTL-5**	**Evaluate**
5.	Explain how the diameter of wafer is controlled in Czochralski process. **(15)**	**BTL-5**	**Evaluate**

UNIT II - CHARACTERISTICS OF OPAMP			
Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.			
PART – A			
Q.N	**Questions**	**BT Level**	**Competenc**
1.	List out the ideal characteristics of an OP-AMP.	**BTL-1**	**Remember**
2.	Define CMRR.	**BTL-1**	**Remember**
3.	A 100 pF capacitor has a maximum charging current of 100 micro amps. Calculate its slew rate.	**BTL-3**	**Apply**
4.	Draw the circuit diagram of a symmetrical emitter coupled differential amplifier.	**BTL-2**	**Understand**
5.	Write some applications of operational amplifier.	**BTL-1**	**Remember**
6.	Why IC 741 is not used for high frequency applications?	**BTL-4**	**Analyze**
7.	What is the maximum undistorted sine-wave that can be obtained for a 10 V peak and 1V peak, if the slew rate of an op-amp is 0.6 V/micro sec?	**BTL-6**	**Create**
8.	Analyze what happens when the common terminal of V+ and V- sources are not grounded?	**BTL-4**	**Analyze**
9.	What is integrator?	**BTL-1**	**Remember**
10.	What do you mean by input offset current and offset voltage?	**BTL-1**	**Remember**
11.	Design an amplifier with a gain of -10 and input resistance of 10kΩ.	**BTL-6**	**Create**
12.	For the circuit diagram shown below determine the output voltage V_0 	**BTL-5**	**Evaluate**

13.	In the circuit shown in figure, calculate V_0, A_{CL}, load current i_L and output current i_0. 	**BTL-5**	**Evaluate**
14.	Sketch an adder circuit to using an op-amp to get the output expression as V_0= -(0.1V_1+V_2+10V_3) where V_1,V_2 and V_3 are the inputs.	**BTL-3**	**Apply**
15.	Draw the circuit diagram of an integrator and give its output equation.	**BTL-2**	**Understand**
16.	Explain how an op-amp can be used as a voltage follower?	**BTL-2**	**Understand**
17.	What is the drawback of IC 741?	**BTL-1**	**Remember**
18.	Compare the ideal and practical op-amp characteristics.	**BTL-4**	**Analyze**
19.	Determine the input impedance of 741 operational amplifier employed as voltage follower having A_v =50,000 and Ri = 0.3Mega Ohm.	**BTL-3**	**Apply**
20.	Draw the circuit diagram of differentiator using Op-amp.	**BTL-2**	**Understand**
21.	Why operational amplifier configurations are not used in linear applications?	**BTL-3**	**Apply**
22.	Find the output offset voltage of an 741 op-amp; If the gain of the non-inverting amplifier is 8.5 and feedback resistor = 15kΩ? (IB=200nA for 741 op-amp)	**BTL-5**	**Evaluate**
23.	In what way, a precision rectifier using op-amp is superior to a conventional rectifier?	**BTL-4**	**Analyze**
24.	What is the value of open loop gain and output impedance of an ideal op-amp?	**BTL-2**	**Understand**
	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**	**Remember**
2.	Explain the following terms in an op-amp **(i)** Bias current. **(3)** **(ii)** Thermal drift.**(3)** **(iii)** Input offset voltage and current.**(4)** **(iv)** Virtual ground.**(3)**	**BTL-1**	**Remember**
3.	Discuss in detail about the DC characteristics of opamp. **(13)**	**BTL-2**	**Understand**
4.	Draw and explain the working principle symmetrical emitter coupled differential amplifier and derive for CMRR. **(13)**	**BTL-1**	**Remember**
5.	Explain the differential amplifier using opamp. **(13)**	**BTL-1**	**Remember**
6.	Determine the frequency response characteristics of an operational amplifier. **(13)**	**BTL-3**	**Apply**
7.	**(i)** Write a note on stability criterion applicable to op-amp circuit. **(3)** **(ii)** Explain in detail about the methods of frequency compensation used in operational amplifiers. **(10)**	**BTL-2**	**Understand**
8.	**(i)** What is Slew rate? Analyze the causes of slew rate and explain its significance in applications. **(9)** **(ii)** Analyze how slew rate can be improved. **(4)**	**BTL-4**	**Analyze**

9.	**(i)** Examine the functions of all the basic building blocks of an Op-Amp. **(7)** **(ii)** Explain the application of op-amp as adder and Subtractor.**(6)**	**BTL-4**	**Analyze**
10.	**(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)** **(ii)** For a non-inverting amplifier using an op-amp assume R_1 = 470 ohm and R_2 = 4.7 kohm. Calculate the closed loop voltage gain of the amplifier. **(3)**	**BTL-2** **BTL-3**	**Understand** **Apply**
11.	**(i)** Write the application of op-amp as differentiator. **(7)** **(ii)** Calculate Vo for the given circuit. **(6)** 	**BTL-1** **BTL-3**	**Remember** **Apply**
12.	**(i)** Deduce an op-amp circuit to give an output voltage$V_0 = 4V_1 - 3V_2 + 5V_3 - V_4$, Where V_1, V2, V_3 and V_4 are inputs. **(8)** **(ii)** Explain the application of op-amp as integrator. **(5)**	**BTL-5** **BTL-4**	**Evaluate** **Analyze**
13.	**(i)** For a max frequency of 100 Hz, Design a differentiator circuit and draw the frequency response for the same. **(7)** **(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**	**Create**
14.	Draw and explain the operation of a current to voltage converter. **(13)**	**BTL-2**	**Understand**
15.	Discuss in detail about the AC characteristics of opamp. **(13)**	**BTL-2**	**Understand**
16.	With diagram explain the working principle of V/I converter. **(13)**	**BTL-5**	**Evaluate**
17.	How common mode rejection ratio can be increased using constant current source? **(13)**	**BTL-3**	**Apply**
	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**	**Evaluate**
2.	Determine the output voltage for the following circuits.**(7+8)** **(i)**  **(ii)** 	**BTL-5**	**Evaluate**
3.	**(i)** Design a circuit to produce $V_0=(V_3+V_4) -(V_1+V_2)$ using Op-Amp. **(8)** **(ii)** Redraw the above designed circuit for $V_2=V_3=V_4$ **(7)**	**BTL-6**	**Create**
4.	Create a double integrator circuit from single integrator circuit and explain its operation. **(15)**	**BTL-6**	**Create**

5.	For the non – inverting amplifier of shown in figure R_1 = 1 KΩ & R_f = 10 KΩ.  i. Calculate the maximum output offset voltage due to V_{os} and I_B. The Op-amp is LM 307 with V_{os} = 10mV, I_B =300nA and I_{os} =50nA. **(5)** ii. Calculate the value of R_{comp} needed to reduce the effect of I_B. **(5)** iii. Calculate the maximum output offset voltage if R_{comp} as calculated in (ii) is connected in the circuit.**(5)**	**BTL-5**	**Evaluate**

UNIT III - APPLICATIONS OF OPAMP			
Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using op amps.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	What are the basic requirements of a good instrumentation amplifier?	**BTL-1**	**Remember**
2.	Summarize the applications of an instrumentation amplifier.	**BTL-2**	**Understand**
3.	State the applications of log amplifier.	**BTL-2**	**Understand**
4.	Draw the circuit of a log amplifier using two opamps.	**BTL-6**	**Create**
5.	What is analog multiplier?		
6.	Analyze why active filters are preferred over passive filters?	**BTL-4**	**Analyze**
7.	Enlist the applications of comparators.	**BTL-2**	**Understand**
8.	What is a Zero crossing detector?	**BTL-1**	**Remember**
9.	Sketch the circuit of an op-amp employed as a non-inverting zero crossing detector, along with input and output waveforms.	**BTL-3**	**Apply**
10.	Summarize the difference between active clipper and passive clipper.	**BTL-5**	**Evaluate**
11.	Infer the advantage of using active clipper over passive clipper?	**BTL-4**	**Analyze**
12.	Write any two applications of clipper and clamper.	**BTL-2**	**Understand**
13.	Draw a peak detector circuit using op-amp. Give the applications of peak detectors	**BTL-6**	**Create**
14.	Draw the circuit of antilog amplifier using op-amp.	**BTL-2**	**Understand**
15.	What is sample and hold circuit? Point out where it is used? Why?	**BTL-4**	**Analyze**
16.	Draw the diagram of sample and hold circuit.	**BTL-2**	**Understand**
17.	List the types of DACs and ADCs.	**BTL-1**	**Remember**
18.	Calculate the value of the LSB, MSB and full scale output for an 8 Bit DAC for the 0 to 12V range.	**BTL-3**	**Apply**
19.	Calculate the number of comparators required for realizing an 8 bit ADC.	**BTL-3**	**Apply**
20.	Which is the fastest ADC? Why?	**BTL-5**	**Evaluate**

21.	What is the purpose of S/H in data converter?	**BTL-2**	**Understand**
22.	How many resistors are required in a 12-bit weighted resistor DAC?	**BTL-5**	**Evaluate**
23.	Point out the different parameters of the D/A and A/D converter given by the manufactures.	**BTL-4**	**Analyze**
24.	An 8 bit DAC has an output voltage range of 0 to 2.55 V. find its resolution.	**BTL-3**	**Apply**
	PART – B		
1.	Draw and explain the circuit of a second order butterworth low pass filter and derive its transfer function. **(13)**	**BTL-6**	**Create**
2.	Discuss about sample and hold circuit and explain its operation. **(13)**	**BTL-2**	**Understand**
3.	**(i)** What are the advantages of continuous type A/D converter over counter type A/D converter? **(2)** **(ii)** Illustrate the working of successive approximation type A/D converter with a neat diagram. **(11)**	**BTL-3** **BTL-5**	**Apply** **Evaluate**
4.	Sketch an instrumentation amplifier using 3 Op-Amp and derive its output voltage equation. **(13)**	**BTL-3**	**Apply**
5.	With neat circuit diagram explain the working of Schmitt trigger using op-amp.**(13)**	**BTL-1**	**Remember**
6.	Explain the application of Instrumentation for transducer bridge circuit.**(13)**	**BTL-1**	**Remember**
7.	Write a note on log and antilog amplifiers using op-amp.**(13)**	**BTL-3**	**Apply**
8.	With neat sketch explain the working principle of weighted resistor DAC using Op-Amp. **(13)**	**BTL-4**	**Analyze**
9.	**(i)** Explain the application of op-amp as clamper circuit. **(7)** **(ii)** With neat sketch explain the operation of triangular waveform generator using op-amp.**(6)**	**BTL-4**	**Analyze**
10.	**(i)** What is a comparator? With neat circuit diagram Explain its characteristics. **(7)** **(ii)** Describe how an Op-Amp will be used as Peak detector. **(6)**	**BTL-1**	**Remember**
11.	**(i)** Explain the operation of dual slope ADC.**(7)** **(ii)** Explain the following characteristics of ADC resolution, accuracy, settling time, linearity. **(6)**	**BLT-5**	**Evaluate**
12.	Explain the operation of Flash type A/D converter.**(13)**	**BTL-4**	**Analyze**
13.	Derive the expression for the analog multiplier and divider with necessary diagrams.**(13)**	**BTL-1**	**Remember**
14.	Discuss multivibrators in detail with neat sketches. **(13)**	**BTL-2**	**Understand**
15.	Explain the first order low pass butterworth filter with neat diagram. Derive its frequency response and plot the same.**(13)**	**BTL-3**	**Apply**
16.	Design a circuit of a clipper which will clip the input signal below a reference voltage. **(13)**	**BTL-5**	**Evaluate**
17.	With neat circuit diagram, explain the operation of R-2R D/A converter.**(6)**	**BTL-2**	**Understand**
	PART – C		
1.	Construct an op-amp based instrumentation amplifier for industrial applications.**(15)**	**BTL-5**	**Evaluate**
2.	**(i)** Design a second order butterworth low pass filter having upper cutoff frequency of 1kHz.**(10)** **(ii)** Explain how to measure the phase difference between two signals. **(5)**	**BTL-6**	**Create**

3.	Develop an op-amp based circuits to perform following mathematical operations: (i)Integration **(5)** (ii)Logarithmic **(5)** (iii)Multiplication **(5)**	**BTL-6**	**Create**
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**	**Evaluate**
5.	Describe the second order high pass filter with its frequency response and design the circuit with the cut-off frequency of 5 KHz.**(15)**	**BTL-5**	**Evaluate**

UNIT IV - SPECIAL ICs			
Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	In what way VCO is different from other oscillators?	**BTL-1**	**Remember**
2.	Point out any two application of 555 Timer in Mono stable mode.	**BTL-4**	**Analyze**
3.	Define duty cycle in astable multivibrator using IC 555.	**BTL-1**	**Remember**
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**	**Evaluate**
5.	Summarize the different stages of operation in a PLL.	**BTL-6**	**Create**
6.	A 10 bit A/D converter has an input voltage of -10 to +10V. Estimate resolution.	**BTL-5**	**Evaluate**
7.	Analyze why VCO is called voltage to frequency converter?	**BTL-4**	**Analyze**
8.	With reference to a VCO, summarize voltage to frequency conversion factor Kv.	**BTL-6**	**Create**
9.	Define lock range and capture range with respect to PLL.	**BTL-1**	**Remember**
10.	State why the phase detector output in a PLL should be followed by a low pass filter.	**BTL-4**	**Analyze**
11.	Outline the applications of NE565.	**BTL-2**	**Understand**
12.	Draw the functional block of 555 timer IC.	**BTL-3**	**Apply**
13.	Define PLL.	**BTL-1**	**Remember**
14.	List the applications of PLL.	**BTL-2**	**Understand**
15.	Give the advantages of variable transconductance technique.	**BTL-2**	**Understand**
16.	What is analog multiplier? Mention its applications.	**BTL-3**	**Apply**
17.	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**	**Remember**
18.	Enlist the important features of 555 timer circuit.	**BTL-6**	**Create**
19.	Draw the circuit diagram of a PLL circuit used as an AM modulator.	**BTL-3**	**Apply**
20.	Define PULL time of PLL.	**BTL-1**	**Remember**
21.	Why invariably a suitable value of capacitor is connected to the pin 5 of 555 timer applications?	**BTL-3**	**Apply**
22.	Point out the application of analog multipliers.	**BTL-4**	**Analyze**
23.	Determine the output pulse width of the Monostable amplifier using 555 timer if R=10kΩ, and C= 0.01µF.	**BTL-5**	**Evaluate**

24.	Draw the relation between the capture range and lock range relationship in a PLL.	**BTL-2**	**Understand**
	PART – B		
1.	**(i)** Discuss the functional diagram of 555 timer and explain in detail.**(7)** **(ii)** Discuss the operation of PWM using 555 timer. **(6)**	**BTL-2**	**Understand**
2.	Describe the block diagram of a VCO and explain its operation. **(13)**	**BTL-2**	**Understand**
3.	With the help of schematic diagram, explain the operation of IC-566. Also derive an expression for the output frequency. **(13)**	**BTL-3**	**Apply**
4.	Derive, design and draw the waveform of a 1 kHz square wave generator using 555 timer for duty cycle of 50% **(13)**	**BTL-6**	**Create**
5.	Evaluate the various phases in the operation of a PLL.**(13)**	**BTL-5**	**Evaluate**
6.	Briefly explain the functional block diagram of NE565 PLL IC to operate as a frequency divider.**(13)**	**BTL-1**	**Remember**
7.	Describe the working principle of the variable trans-conductance analog multiplier.**(13)**	**BTL-1**	**Remember**
8.	For the astable circuit, derive the expression for high state time interval, low state time interval, period, frequency and duty cycle.**(13)**	**BTL-3**	**Apply**
9.	Explain the working of PLL using appropriate block diagram and analyze how it can be used as frequency translator.**(13)**	**BTL-4**	**Analyze**
10.	**(i)** Discuss the operation of a FSK generator using 555 timer.**(7)** **(ii)** Describe any two applications of PLL.**(6)**	**BTL-1**	**Remember**
11.	Examine the operation of a free running oscillator and bistable multivibrator using IC555 with necessary waveforms.**(13)**	**BTL-3**	**Apply**
12.	What is PLL? How frequency multiplication is done using PLL? **(13)**	**BTL-4**	**Analyze**
13.	**(i)** Explain functional block diagram of NE565 phase locked loop. **(7)** **(ii)** Narrate the process of FSK demodulation using PLL. **(6)**	**BTL-2**	**Understand**
14.	With block diagram explain the principle of operation of NE565.**(13)**	**BTL-1**	**Remember**
15.	Explain the operation of AD633 analog multiplier IC. **(13)**	**BTL-2**	**Understand**
16.	Explain the astable operation of IC555 with necessary waveforms. **(13)**	**BTL-3**	**Apply**
17.	In Astable multivibrator using 555 timer R_a=2.2 Kohm, R_b=6.8Kohm and C=0.01microfarad. Calculate T_{high}, T_{low}, free running frequency and duty cycle.**(13)**	**BTL-5**	**Evaluate**
	PART – C		
1.	Design a monostable multivibrator with pulse duration of 1ms using 555 timer IC. **(15)**	**BTL-6**	**Create**
2.	Configure a circuit using analog multiplier to measure the square and square root of a signal. **(15)**	**BTL-5**	**Evaluate**
3.	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**	**Evaluate**
4.	Design a frequency synthesizer circuit using PLL IC 565. Explain in detail about the operation and applications of it. **(15)**	**BTL-6**	**Create**
5.	Briefly explain the difference between the two operating modes of 555 timer. **(15)**	**BTL-5**	**Evaluate**

UNIT V - APPLICATION ICs

AD623 Instrumentation Amplifier and its application as load cell weight measurement – ICvoltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linearpower supply - LM317, 723 Variable voltage regulators, switching regulator- SMPS – ICL8038 function generator IC.

PART – A

Q.No	Questions	BT Level	Competence
1.	List the characteristics of optocoupler.	**BTL-1**	**Remember**
2.	Give some examples of monolithic IC voltage regulators.	**BTL-2**	**Understand**
3.	Give one comparison for switching regulator and variable voltage regulator.	**BTL-2**	**Understand**
4.	What is an isolation amplifier?	**BTL-1**	**Remember**
5.	Point out the various protection circuits used for series voltage regulators.	**BTL-4**	**Analyze**
6.	Why do switching regulators have better efficiency than the series regulator?	**BTL-5**	**Evaluate**
7.	How current boosting is achieved in a 723 IC?	**BTL-5**	**Evaluate**
8.	Analyze the purpose of using an external pass transistor with an IC voltage regulator.	**BTL-4**	**Analyze**
9.	What is SMPS?	**BTL-1**	**Remember**
10.	State the need for protection diodes in voltage regulators based on LM317 regulator.	**BTL-1**	**Remember**
11.	Draw the pin diagram of IC 723 regulator.	**BTL-3**	**Apply**
12.	What are the applications of fixed voltage regulator?	**BTL-1**	**Remember**
13.	Develop the expression for output voltage in LM317.	**BTL-6**	**Create**
14.	Summarize any two application of isolation amplifier.	**BTL-6**	**Create**
15.	Define load regulation and line regulation.	**BTL-1**	**Remember**
16.	List the features of optocoupler ICs.	**BTL-1**	**Remember**
17.	Relate ripple rejection with respect to voltage regulators.	**BTL-3**	**Apply**
18.	What are the limitations of three terminal regulator?	**BTL-2**	**Understand**
19.	Analyze the important performance parameters of 3 terminal IC regulators.	**BTL-4**	**Analyze**
20.	How are frequency of triangular waveforms, obtained using ICL 8038 function generator?	**BTL-3**	**Apply**
21.	Differentiate between linear and switching regulators.	**BTL-3**	**Apply**
22.	What is the need for current limiting in regulated power supplies?	**BTL-4**	**Analyze**
23.	What are the drawbacks of simple current limiting and how is it overcome?	**BTL-5**	**Evaluate**
24.	Draw pin diagram of IC 8038.	**BTL-2**	**Understand**

PART – B

1.	**(i)** Discuss about the functional diagram of 723 IC regulator in detail. **(7)** **(ii)** Explain the fold back characteristics of 723 IC regulator. **(6)**	**BTL-2**	**Understand**
2.	Explain the working principle of basic linear voltage regulator using op-amp.	**BTL-2**	**Understand**
3.	Write a detailed note on switching regulators. **(13)**	**BTL-1**	**Remember**
4.	Write short notes on **(i)** LM 317 Voltage Regulator.**(7)** **(ii)** ICL 8038 Function Generator IC. **(6)**	**BTL-1**	**Remember**
5.	What is the principle of switched mode power supplies? Discuss its merits and demerits. **(13)**	**BTL-1**	**Remember**

6.	Illustrate the working of series voltage regulator. **(13)**	**BTL-4**	**Analyze**
7.	Explain AD623 Instrumentation amplifier IC with neat sketch. **(13)**	**BTL-3**	**Apply**
8.	Design an adjustable voltage regulator (5V to 15V) with a short circuit current of limit 50mA using 723 regulator.**(13)**	**BTL-6**	**Create**
9.	**(i)** Explain protective circuits in regulators. **(7)** **(ii)** Justify the role of Isolation amplifiers. **(6)**	**BTL-5**	**Evaluate**
10.	Explain the operation of LM79XX fixed voltage regulator with necessary diagram. **(13)**	**BTL-3**	**Apply**
11.	Briefly explain the switched mode power supply with necessary circuit diagrams and waveforms.	**BTL-3**	**Apply**
12.	Explain the operation of LM78XX fixed voltage regulator with necessary diagram. **(13)**	**BTL-2**	**Understand**
13.	Write a detailed note on the application of opto couplers and fixed voltage regulators. **(13)**	**BTL-1**	**Remember**
14.	What do you mean by the fixed voltage and variable voltage regulators? List its various applications **(13)**	**BTL-4**	**Analyze**
15.	With neat diagram, explain the working of step down switching regulator. **(13)**	**BTL-2**	**Understand**
16.	Discuss on the different types of three terminal voltage regulators. **(13)**	**BTL-3**	**Apply**
17.	Draw the circuit diagram and explain the operation of any one negative voltage regulator. **(13)**	**BTL-5**	**Evaluate**
	PART – C		
1.	Using 7805 design a current source to deliver 0.2A current to 22Ω, 10Watt load. **(15)**	**BTL-6**	**Create**
2.	Discuss about the fixed voltage regulators application as Linear power supply.**(15)**	**BTL-5**	**Evaluate**
3.	How will you design a voltage regulator using IC723 regulator to satisfy the following specifications. **(15)** (i) V_0 = 12 V, (ii) I_0 = 500 mA, (iii) V_{in} = 18±20%, (iv) I_{sc} = 600 mA, (v) V_{Sense} = 0.7 V. Give the complete schematic diagram. Assume and Justify if any data required.	**BTL-5**	**Evaluate**
4.	Using 7805 Voltage regulator, Specify suitable component values to get Vo=7.5 V **(15)**	**BTL-6**	**Create**
5.	Draw the functional block diagram of IC 723 voltage regulator and explain its working as a basic low voltage regulator. Design the same for an output of 5v and load current upto 200 mA. **(15)**	**BTL-5**	**Evaluate**