

SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)
SRM Nagar, Kattankulathur – 603 203

**DEPARTMENT
OF
ELECTRONICS AND INSTRUMENTATION ENGINEERING**

QUESTION BANK



IV SEMESTER
EI3463 –Electronics for Analog signal Processing

Regulation - 2023

Academic Year: 2024-2025 (EVEN)

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SUBJECT : EI3463 –Electronics for Analog signal Processing
SEM / YEAR: IV / II

UNIT I OPERATIONAL AMPLIFIER CHARACTERISTICS

Introduction to Fabrication of integrated circuits, Functional block diagram and operation of Op-amp, Ideal Characteristics of Op-amp, DC Characteristics: Input bias current, Input offset current, Input offset voltage and Thermal drift, AC Characteristics: Frequency response, stability, frequency compensation, slew rate and methods of improving slew rate.

PART – A

Q.No	Questions	COs	BT Level	Competence
1.	Difference between monolithic and hybrid ICs.	CO1	BTL-2	Understand
2.	List the advantages of integrated circuits over discrete component circuits.	CO1	BTL-2	Understand
3.	Distinguish between dry etching and wet etching.	CO1	BTL-1	Remember
4.	List the steps used for preparation of silicon wafer.	CO1	BTL-2	Understand
5.	List the basic process used in IC fabrication.	CO1	BTL-1	Remember
6.	Point out the popular IC package configurations available.	CO1	BTL-1	Remember
7.	What is the value of open loop gain and output impedance of an ideal op-amp?	CO1	BTL-2	Understand
8.	What is an OP-Amp? Draw the circuit symbol of an OP-Amp.	CO1	BTL-1	Remember
9.	List out the ideal characteristics of an OP-AMP.	CO1	BTL-2	Understand
10.	Compare the ideal and practical op-amp characteristics.	CO1	BTL-2	Understand
11.	Write some applications of operational amplifier.	CO1	BTL-1	Remember
12.	Define virtual ground concept	CO1	BTL-2	Understand
13.	What do you mean by input offset current?	CO1	BTL-2	Understand
14.	What do you mean by offset voltage?	CO1	BTL-1	Remember
15.	Write about thermal drift in Op-amp.	CO1	BTL-1	Remember
16.	Give the type of External frequency compensation in op-amp.	CO1	BTL-1	Remember
17.	Define Input bias current	CO1	BTL-1	Remember
18.	Define CMRR.	CO1	BTL-1	Remember

19.	Define Slew rate	CO1	BTL-1	Remember
20.	What happens when the common terminal of V+ and V- sources are not grounded?	CO1	BTL-2	Understand
21.	A 100 pF capacitor has a maximum charging current of 100 micro amps. Calculate its slew rate.	CO1	BTL-2	Understand
22.	Draw the circuit diagram of a symmetrical emitter coupled differential amplifier.	CO1	BTL-2	Understand
23.	Why IC 741 is not used for high frequency applications?	CO1	BTL-2	Understand
24.	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?	CO1	BTL-2	Understand
PART- B				
1.	Construct a typical transistor from the fabrication techniques of monolithic ICs and briefly explain the process involved in it. (16)	CO1	BTL-4	Analyze
2.	(i) What is thin and thick film technology? (4)	CO1	BTL-3	Apply
	(ii) Describe the various methods used for deposition of thin film technology.(12)	CO1	BTL-3	Apply
3.	Discuss in detail about diffusion and ion implantation process in IC fabrication. (16)	CO1	BTL-3	Apply
4.	Describe the functions of all the basic building blocks of an Op-Amp. (16)	CO1	BTL-3	Apply
5.	List the six characteristics of an ideal op-amp and explain in detail and give the practical op-amp equivalent circuit. (16)	CO1	BTL-4	Analyze
6.	Discuss in detail about the DC characteristics of Op-Amp. (16)	CO1	BTL-4	Analyze
7.	Explain about the ideal Op-Amp characteristics. (16)	CO1	BTL-4	Analyze
8.	Draw and explain the working principle symmetrical emitter coupled differential amplifier and derive for CMRR. (16)	CO1	BTL-3	Apply
9.	Discuss in detail about the DC and AC characteristics of Op-Amp. (16)	CO1	BTL-3	Apply
10.	(i) What is input and output voltage and current offset? How are they compensated? (9)	CO1	BTL-4	Analyze
	(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)			
11.	Determine the frequency response characteristics of an operational amplifier. (16)	CO1	BTL-3	Apply
12.	How common mode rejection ratio can be increased using constant	CO1	BTL-3	Apply

	current source? (16)				
13.	(i)	Write a note on stability criterion applicable to op-amp circuit (4)	CO1	BTL-4	Analyze
	(ii)	Explain in detail about the methods of frequency compensation used in operational amplifiers. (12)	CO1	BTL-4	Analyze
14.	Explain the following terms in an op-amp		CO1	BTL-4	Analyze
	(i)	Bias current. (4)	CO1	BTL-3	Apply
	(ii)	Thermal drift. (4)	CO1	BTL-3	Apply
	(iii)	Input offset voltage and current. (4)	CO1	BTL-3	Apply
15.	(i)	Determine the frequency response characteristics of an operational amplifier. (9)	CO1	BTL-4	Analyze
	(ii)	How common mode rejection ratio can be increased using constant current source? (7)	CO1	BTL-4	Analyze
16.	(i)	Write a note on stability criterion applicable to op- amp circuit. (4)	CO1	BTL-3	Apply
	(ii)	Explain in detail about the methods of frequency compensation used in operational amplifiers. (12)			
17.	(i)	What is Slew rate? Analyze the causes of slew rate and explain its significance in applications. (10)	CO1	BTL-4	Analyze
	(ii)	How slew rate can be improved? (6)	CO1	BTL-4	Analyze

UNIT II APPLICATIONS OF OPAMP

Basic operation of Inverting and Non Inverting amplifiers, Voltage follower, Adder, Subtractor, Integrator, Differentiator, Instrumentation amplifier and its applications for transducer Bridge, Differential amplifier, Voltage to current and Current to voltage converters, clippers, clampers, peak detector, Precision rectifier, Sample and hold circuits.

1.	Draw the circuit diagram of Non inverting amplfier	CO2	BTL-1	Remember
2.	State the gain of the Inverting amplifier	CO2	BTL-1	Remember
3.	What is meant by inverting amplifier ?	CO2	BTL-1	Remember
4.	Give the schematic of Unity follower	CO2	BTL-1	Remember
5.	How an op-amp can be used as a voltage follower?	CO2	BTL-2	Understand
6.	Draw the circuit diagram of Non inverting summer.	CO2	BTL-2	Understand
7.	Sketch the integrator using Op-amp	CO2	BTL-1	Remember
8.	Illustrate some of the important features of an instrumentation amplifier.	CO2	BTL-2	Understand
9.	What are the basic requirements of a good instrumentation amplifier?	CO2	BTL-2	Understand
10.	Summarize the applications of an instrumentation amplifier.	CO2	BTL-1	Remember
11.	What is the need for converting a first order filter into a second order filter?	CO2	BTL-2	Understand
12.	Enumerate the advantages & disadvantages of passive filters?	CO2	BTL-2	Understand
13.	Analyze why active filters are preferred over passive filters?	CO2	BTL-2	Understand

14.	Define comparator and function of a phase shift circuit ?	CO2	BTL-1	Remember
15.	Draw the circuit diagram of differentiator using Op-amp.	CO2	BTL-2	Understand
16.	What is a V to I convertor?	CO2	BTL-1	Remember
17.	What is an I to V convertor?	CO2	BTL-1	Remember
18.	Summarize the difference between active clipper and passive clipper.	CO2	BTL-2	Understand
19.	Infer the advantage of using active clipper over passive clipper?	CO2	BTL-2	Understand
20.	Write any two applications of clipper and clamper.	CO2	BTL-1	Remember
21.	Draw a peak detector circuit using op-amp. Give the applications of peak detectors	CO2	BTL-1	Remember
22.	How a precision rectifier using op-amp is superior to a conventional rectifier?	CO2	BTL-2	Understand
23.	What is sample and hold circuit? Point out where it is used? Why?	CO2	BTL-2	Understand
24.	Draw the diagram of sample and hold circuit.	CO2	BTL-1	Remember
PART- B				
1.	(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. (12)	CO2	BTL-4	Analyze
	(ii) For a non-inverting amplifier using an op-amp assume $R_i = 470$ ohm and $R_f = 4.7$ kohm. Calculate the closed loop voltage gain of the amplifier. (4)	CO2	BTL-4	Analyze
2.	Explain the application of op-amp as adder and Subtractor. (16)	CO2	BTL-4	Analyze
3.	Deduce an op-amp circuit to give an output voltage $V_0 = 4V_1 - 3V_2 + 5V_3 - V_4$, Where V_1, V_2, V_3 and V_4 are inputs. (16)	CO2	BTL-3	Apply
4.	Compare and contrast Adder, Subtractor circuit using op-amp with equations. (16)	CO2	BTL-3	Apply
5.	Explain about the differentiator circuit and draw the frequency response for the same. (16)	CO2	BTL-4	Analyze
6.	Design a differentiator circuit and draw the frequency response for the same. (16)	CO2	BTL-3	Apply
7.	Explain the application of Instrumentation for transducer bridge circuit. (16)	CO2	BTL-4	Analyze
8.	Explain AD623 Instrumentation amplifier IC with neat sketch. (16)	CO2	BTL-4	Analyze
9.	Sketch an instrumentation amplifier using 3 Op-Amp and derive its output voltage equation. (16)	CO2	BTL-4	Analyze
10.	Explain the differential amplifier using Op-Amp. (16)	CO2	BTL-3	Apply
11.	Draw and explain the operation of a current to voltage converter. (16)	CO2	BTL-4	Analyze
12.	With diagram explain the working principle of V/I converter. (16)	CO2	BTL-4	Analyze

13.	Design a circuit of a clipper which will clip the input signal below a reference voltage. (16)	CO2	BTL-4	Analyze
14.	(i) Explain the application of op-amp as clamper circuit. (9) (ii) With neat sketch explain the operation of triangular waveform generator using op-amp.(7)	CO2	BTL-4	Analyze
15.	(i) Discuss about sample and hold circuit and explain its operation. (9) (ii) Design a circuit of a clipper which will clip the input signal below a reference voltage. (7)	CO2	BTL-3	Apply
16.	(i) Describe how an Op-Amp will be used as Peak detector. (6)	CO1	BTL-3	Apply
	(ii) Explain about Precision rectifier (10)	CO1	BTL-3	Apply
17.	Discuss about sample and hold circuit and explain its operation.(16)	CO2	BTL-4	Analyze

UNIT III COMPARATORS AND WAVEFORM GENERATORS

Analog multiplier & Divider, first and second order active filters, Basic operation and applications of Comparator, Schmitt trigger, waveform generators, ICL 8038 function generator IC, Monostable, Astable and Bistable Multivibrators, Log and Antilog amplifier.

PART – A

Q.No	Questions	COs	BT Level	Competence
1.	What is analog multiplier?	CO3	BTL-1	Remember
2.	Mention the few applications of analog multiplier.	CO3	BTL-2	Understand
3.	Define analog multiplier?	CO3	BTL-1	Remember
4.	State any two multiplier ICs	CO3	BTL-2	Understand
5.	Point out the application of analog multipliers.	CO3	BTL-1	Remember
6.	List the performance parameters of the multiplier	CO3	BTL-1	Remember
7.	Why active filters are preferred over passive filters?	CO3	BTL-2	Understand
8.	List the applications of comparators.	CO3	BTL-2	Understand
9.	Draw the circuit diagram of a squaring circuit using multiplier.	CO3	BTL-1	Remember
10.	What is a Zero crossing detector?	CO3	BTL-1	Remember
11.	Sketch the circuit of an op-amp employed as a non-inverting zero crossing detector, along with input and output waveforms.	CO3	BTL-2	Understand
12.	Discuss about Schmitt trigger	CO3	BTL-1	Remember
13.	Point out any two application of 555 Timer in Mono stable mode.	CO3	BTL-2	Understand
14.	Define duty cycle in astable multivibrator using IC 555.	CO3	BTL-1	Remember
15.	List the application of Astable multivibrator	CO3	BTL-2	Understand
16.	Give the details of function generator ICs	CO3	BTL-1	Remember

17.	What is meant by monostable multivibrator	CO3	BTL-2	Understand
18.	Define Astable Multivibrator	CO3	BTL-2	Understand
19.	Discuss about Bistable multivibrator	CO3	BTL-1	Remember
20.	Write the applications of multivibrator.	CO3	BTL-1	Remember
21.	State the applications of log amplifier.	CO3	BTL-2	Understand
22.	Draw the circuit of a log amplifier using two opamps.	CO3	BTL-2	Understand
23.	Give the use of log amplifier	CO3	BTL-1	Remember
24.	Draw the circuit of antilog amplifier using op-amp.	CO3	BTL-2	Understand
PART – B				
1.	Derive the expression for the analog multiplier and divider with necessary diagrams.(16)	CO3	BTL-3	Apply
2.	Describe the working principle of the variable trans-conductance analog multiplier.(16)	CO3	BTL-4	Analyze
3.	Explain the process of frequency doubler using analog multiplier with necessary equations. (16)	CO3	BTL-4	Analyze
4.	Summarize the following application of Multiplier with necessary diagram and equations. (i) Phase angle detection (8) (ii) RMS detector (8)	CO3	BTL-3	Apply
5.	Explain the various operation of AD533 analog multiplier IC. (16)	CO3	BTL-4	Analyze
6.	Explain the first order low pass filter with neat diagram. Derive its frequency response and plot the same.(16)	CO3	BTL-3	Apply
7.	Draw and explain the circuit of a second order low pass filter and derive its transfer function. (16)	CO3	BTL-3	Apply
8.	What is a comparator? With neat circuit diagram Explain its types. (16)	CO3	BTL-3	Apply
9.	With neat circuit diagram explain the working of Schmitt trigger using op-amp. (16)	CO3	BTL-4	Analyze
10.	Explain about ICL 8038 Function Generator IC. (16)	CO3	BTL-3	Apply
11.	Describe about the generation of triangular wave generation using Op-amps. (16)	CO3	BTL-4	Analyze
12.	For the astable circuit, derive the expression for high state time interval, low state time interval, period, frequency and duty cycle. (16)	CO3	BTL-3	Apply
13.	Discuss Monostable multivibrators in detail with neat sketches. (16)	CO3	BTL-4	Analyze
14.	Describe the operation of a bistable multivibrator using Op-amp with necessary waveforms.(16)	CO3	BTL-4	Analyze
15.	Explain the astable operation of Op-amp with necessary waveforms. (16)	CO3	BTL-3	Apply

16.	In Astable multivibrator using 555 timer $R_a=2.2$ K ohm, $R_b=6.8$ Kohm and $C=0.01$ microfarad. Calculate T_{high} , T_{low} , free running frequency and duty cycle.(16)	CO3	BTL-4	Analyze
17.	Write a note on log and antilog amplifiers using op-amp.(16)	CO3	BTL-4	Analyze

UNIT IV SIGNAL CONVERTERS

Need for D-A&A – D converter, D-A converter: Weighted resistor, R-2R ladder, and inverted R-2R types. A – D converter: Flash, Counter, Servo tracking, Successive approximation, Dual slope types. DAC and ADC performance characteristics, examples of ADC, DAC IC's.

PART – A

Q.No	Questions	COs	BT Level	Competence
1.	What are the specifications of D/A Converter			
2.	An 8 bit DAC has an output voltage range of 0 to 2.55 V. find its resolution.	CO4	BTL-2	Understand
3.	Calculate the value of the LSB, MSB and full scale output for an 8 Bit DAC for the 0 to 12V range.	CO4	BTL-2	Understand
4.	How many resistors are required in a 12-bit weighted resistor DAC?	CO4	BTL-2	Understand
5.	What is meant by conversion time of DAC?	CO4	BTL-1	Remember
6.	Define the resolution of DAC converter.	CO4	BTL-1	Remember
7.	Find the resolution of the a 12 bit D/A converter	CO4	BTL-1	Remember
8.	Give the basic types of DAC.	CO4	BTL-1	Remember
9.	Define settling time of DAC.	CO4	BTL-1	Remember
10.	What are the drawbacks of binary weighted DAC?	CO4	BTL-1	Remember
11.	Point out the different parameters of the D/A and A/D converter given by the manufactures.	CO4	BTL-1	Remember
12.	Calculate the number of comparators required for realizing an 8 bit ADC.	CO4	BTL-2	Understand
13.	List the types of DACs and ADCs.	CO4	BTL-1	Remember
14.	What are current driven DACs	CO4	BTL-2	Understand
15.	Which is the fastest ADC? Why?	CO4	BTL-2	Understand
16.	Define conversion time of ADC	CO4	BTL-1	Remember
17.	List the basic A/D Conversion techniques.	CO4	BTL-1	Remember
18.	List the advantages of dual slope ADC	CO4	BTL-1	Remember
19.	Give the advanatges of integrating type ADC.	CO4	BTL-2	Understand
20.	A 10 bit A/D converter has an input voltage of -10 to +10V. Estimate resolution.	CO4	BTL-2	Understand
21.	What is meant by servo tracking A/D converter	CO4	BTL-1	Remember
22.	State the disadvantages of counter type	CO4	BTL-1	Remember
23.	How many clock periods are required for an 8 bit successive approximation ADC for a single conversion?	CO4	BTL-2	Understand

24.	Which type of ADC is used in all Digital voltmeter.	CO4	BTL-2	Understand
PART – B				
1.	With neat sketch explain the working principle of weighted resistor DAC using Op-Amp. (16)	CO4	BTL-4	Analyze
2.	With neat circuit diagram, explain the operation of R-2R D/A converter.(16)	CO4	BTL-3	Apply
3.	Describe about the R-2R ladder DAC with necessary diagrams.(16)	CO4	BTL-4	Analyze
4.	Explain about the Inverted R-2R ladder DAC with necessary diagrams.(16)	CO4	BTL-4	Analyze
5.	Summarize about the following (i) Multiplying DAC (3) (ii) Monolithic DAC (13)	CO4	BTL-3	Apply
6.	Explain the operation of Flash type A/D converter with neat diagram . (16)	CO4	BTL-4	Analyze
7.	Describe about the parallel comparator A/D converter with necessary diagram. . (16)	CO4	BTL-3	Apply
8.	(i) Explain about the Counter type A/D converter with neat diagram.(8)	CO4	BTL-4	Analyze
	(ii) Summarize the servo tracking type A/D converter with neat diagram .(8)	CO4	BTL-4	Analyze
9.	(i) What are the advantages of continuous type A/D converter over counter type A/D converter? (3)	CO4	BTL-3	Apply
	(ii) Illustrate the working of successive approximation type A/D converter with a neat diagram. (13)			
10.	(i) Explain the operation of dual slope ADC.(9)	CO4	BTL-3	Apply
	(ii) Explain the following characteristics of ADC resolution, accuracy, settling time, linearity. (7)			
11.	Explain the operation of dual slope ADC with necessary diagram . (16) .	CO4	BTL-4	Analyze
12.	Illustrate the working of successive approximation type A/D converter with a neat diagram. (16)	CO4	BTL-3	Apply
13.	Compare and contrast various types of ADCs. (16)	CO4	BTL-4	Analyze
14.	(i) Summarize about Charge balancing ADC.(8)	CO4	BTL-4	Analyze
	(ii) Describe neatly the Dual slope Integrating type ADC. (8)	CO4	BTL-4	Analyze
15.	Explain the following characteristics of ADC resolution, accuracy, settling time, linearity. (16)	CO4	BTL-3	Apply

16.	Summarize about the DAC and ADC performance characteristics. (16)	CO4	BTL-4	Analyze
17.	With neat diagram explain about the examples of ADC and DC Ic's. (16)	CO4	BTL-3	Apply

UNIT V SPECIAL ICs

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, IC voltage regulators – LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variable voltage regulators, switching regulator- SMPS.

PART – A

Q.No	Questions	COs	BT Level	Competence
1.	Enlist the important features of 555 timer circuit.	CO3	BTL-1	Remember
2.	Draw the functional block of 555 timer IC.	CO3	BTL-1	Remember
3.	In what way VCO is different from other oscillators?	CO3	BTL-1	Remember
4.	Why VCO is called voltage to frequency converter?	CO3	BTL-2	Understand
5.	With reference to a VCO, summarize voltage to frequency conversion factor Kv.	CO3	BTL-2	Understand
6.	Define PLL.	CO3	BTL-1	Remember
7.	List the applications of PLL.	CO3	BTL-2	Understand
8.	Outline the applications of NE565.	CO3	BTL-2	Understand
9.	What are the applications of fixed voltage regulator?	CO4	BTL-1	Remember
10.	List two application of isolation amplifier.	CO4	BTL-1	Remember
11.	Define load regulation and line regulation.	CO4	BTL-1	Remember
12.	Write the ripple rejection with respect to voltage regulators.	CO4	BTL-2	Understand
13.	What are the drawbacks of simple current limiting and how is it overcome?	CO4	BTL-2	Understand
14.	What is the need for current limiting in regulated power supplies?	CO4	BTL-2	Understand
15.	Compare switching regulator and variable voltage regulator.	CO4	BTL-2	Understand
16.	What is the important performance parameters of 3 terminal IC regulators?	CO4	BTL-2	Understand
17.	What are the limitations of three terminal regulator?	CO4	BTL-2	Understand
18.	Differentiate between linear and switching regulators.	CO4	BTL-2	Understand
19.	What is the need for protection diodes in voltage regulators based on LM317 regulator?	CO4	BTL-1	Remember
20.	Write the expression for output voltage in LM317.	CO4	BTL-1	Remember
21.	Draw the pin diagram of IC 723 regulator.	CO4	BTL-1	Remember
22.	How current boosting is achieved in a 723 IC?	CO4	BTL-2	Understand
23.	What is SMPS?	CO4	BTL-1	Remember
24.	Why do switching regulators have better efficiency than the series regulator?	CO4	BTL-2	Understand

PART – B

1.	(i) Discuss the functional diagram of 555 timer and explain in detail.(9) (ii) Discuss the operation of PWM using 555 timer. (7)	CO5	BTL-4	Analyze
2.	Derive, design and draw the waveform of a 1 kHz square wave generator using 555 timer for duty cycle of 50% .(16)	CO5	BTL-3	Apply
3.	With the help of schematic diagram, explain the operation of IC-566. Also derive an expression for the output frequency. (16)	CO5	BTL-3	Apply
4.	Describe the block diagram of a VCO and explain its operation. (16)	CO5	BTL-3	Apply
5.	Explain the working of PLL using appropriate block diagram and analyze how it can be used as frequency translator.(16)	CO5	BTL-4	Analyze
6.	(i) Explain functional block diagram of NE565 phase locked loop. (9) (ii) Narrate the process of PLL as a frequency divider. (7)	CO5	BTL-3	Apply
7.	Evaluate the various phases in the operation of a PLL.(16)	CO5	BTL-4	Analyze
8.	Briefly explain the functional block diagram of NE565 PLL IC to operate.(16)	CO5	BTL-3	Apply
9.	With block diagram explain the principle of operation of NE565.(16)	CO5	BTL-3	Apply
10.	Explain the working principle of basic linear voltage regulator using op-amp. (16)	CO5	BTL-4	Analyze
11.	Explain the operation of LM78XX fixed voltage regulator with necessary diagram. (16)	CO5	BTL-3	Apply
12.	Explain the operation of LM79XX fixed voltage regulator with necessary diagram. (16)	CO5	BTL-3	Apply
13.	Write short notes on (i) LM 317 Voltage Regulator.(7) (ii) Series voltage regulator (9)	CO5	BTL-4	Analyze
14.	(i) Discuss about the functional diagram of 723 IC regulator in detail. (9) (ii) Explain the fold back characteristics of 723 IC regulator. (7)	CO5	BTL-4	Analyze
15.	Write a detailed note on switching regulators. (16)	CO5	BTL-3	Apply
16.	With neat diagram, explain the working of step down switching regulator. (16)	CO5	BTL-4	Analyze
17.	Briefly explain the switched mode power supply with necessary circuit diagrams and waveforms. (16)	CO5	BTL-4	Analyze