

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Examination December 2021 (2019 Scheme)

Course Code: ECT301

Course Name: LINEAR INTEGRATED CIRCUITS

Max. Marks: 100 | Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

1. Define the parameter CMRR of an op-amp. Given that an operational amplifier produces an output voltage of 50 mV when the input voltages V_1 and V_2 are equal to 10 V and output voltage of 10 V when $V_1 = 10 \text{ mV}$ and $V_2 = 20 \text{ mV}$. Determine the CMRR in dB (p. 1).
2. Draw the ideal and practical voltage transfer characteristics of an op-amp and explain the difference (p. 1).
3. Design an inverting amplifier for a closed loop voltage gain of 10 (p. 1).
4. Draw the input-output waveforms for the circuit shown in the figure (Schmitt trigger circuit with 2V reference) (p. 1).
5. Draw the circuit diagram of a triangular wave generator using op-amp (p. 1).
6. Design a first order high pass filter for a cut off frequency of 1 kHz and maximum gain of 11 (p. 1).
7. Draw and list the functions of 555 timer IC pins (p. 1).
8. Explain the terms (i) Pull in time (ii) Capture range and (iii) Lock range with respect to a PLL (p. 1).
9. Define the terms (i) Resolution (ii) Settling time and (iii) Monotonicity with respect to a DAC (p. 1).

10. Explain the terms (i) Line regulation and (ii) Load regulation for a regulated power supply (p. 1).
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PART B

(Answer one full question from each module, each question carries 14 marks)

Module - 1

11. a) Analyse the differential amplifier circuit using BJT and derive an expression for differential mode gain and common mode gain (7 marks) (p. 2).

b) Draw the circuit diagram of a Wilson current source and derive an expression for output current in terms of the reference current (7 marks) (p. 2).

OR

12. a) 1. Define Slew rate and derive the expression for maximum input frequency at which an undistorted signal is obtained in terms of slew rate. 2. Define Input offset voltage and Input offset current (7 marks) (p. 2).

b) Determine the values of current I_{o1} and I_{o2} in the

circuit shown. Assume $V_{BE} = 0.7 \text{ V}$,

$V_T = 25 \text{ mV}$ and $\beta = 125$ (7 marks) (p. 2).

Module - 2

13. a) Derive an expression for voltage gain, input resistance and output resistance of a voltage series feedback amplifier (7 marks) (p. 2).

b) Design a circuit to obtain the transfer characteristics shown (clipping circuit). Draw the input output waveforms also (7 marks) (pp. 2-3).

OR

14. a) Analyze the summing amplifier circuit given and derive an expression for the output voltage (7 marks) (p. 3).

b) Draw the circuit of a Half wave Precision rectifier and explain its working (7 marks) (p. 3).

Module - 3

15. a) Draw the circuit diagram of a Wien bridge oscillator using op-amp and derive an expression for frequency of oscillations (7 marks) (p. 3).

b) Draw the circuit diagram of a Band Pass filter and derive an expression for the transfer function (7 marks) (p. 3).

OR

16. a) Design a circuit to generate a square wave of frequency 2 kHz and amplitude $10 V_{PP}$ using op-amp. Assume duty cycle is 50% (7 marks) (p. 3).

b) Derive the transfer function of a second order Butterworth low pass filter (7 marks) (p. 3).

Module - 4

17. a) With a neat functional diagram and waveforms, explain the working of a monostable multivibrator using 555 timer IC (7 marks) (p. 3).

b) With block diagram, explain the working a phase locked loop (7 marks) (p. 3).

OR

18. a) Explain the block diagram of a voltage-controlled oscillator (7 marks) (p. 4).

b) Discuss in detail any 3 applications of PLL (7 marks) (p. 4).

Module - 5

19. a) Explain the working of a flash type analog to digital converter (7 marks) (p. 4).

b) Explain how current fold back and current boosting are done using IC 723 voltage regulator (7 marks) (p. 4).

OR

20. a) Explain the working of a successive approximation type ADC (7 marks) (p. 4).

b) Explain the working of a weighted resistor type DAC. Mention its drawbacks (7 marks) (p. 4).