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Your Roll No.....

Sr. No. of Question Paper : 1566 **G**

Unique Paper Code : 2512012302

Name of the Paper : Analog Electronics II

Name of the Course : **B.Sc. (H) Electronics**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question **1** is compulsory.
3. Attempt **Five** Questions in all.
4. Use of non-programmable scientific calculator is allowed.

1. (a) Explain why open loop configuration is unsuitable for linear applications. (3)

   (b) The output voltage of an op amp. changes by 10V in 2 μs. Determine the slew rate. What is the ideal value for 741 op-amp? (3)

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(c) Define CMRR. For a given op-amp, CMRR = 200000 and differential gain $A_d = 10^5$. Determine the common mode gain A_{cm} in dB. (3)

(d) Discuss limitations of a basic differentiator and how it is removed. (3)

(e) What are characteristics of comparators and its limitations? (3)

(f) What are two basic modes in which the 555 Timer operates? Specify one application each for both the modes. (3)

2. (a) Derive expression for voltage gain (A_f), input resistance (R_{if}), output resistance (R_{of}) and bandwidth (f_f) of inverting amplifier using op-amp. (8)

(b) How inverting amplifier is modified as current to voltage converter? Give its circuit. (4)

(c) Explain and draw block diagram of an op-amp. Also draw the voltage transfer curve of an op-amp (Assume output offset voltage is zero). Compare any four characteristics of ideal op-amp with Op-amp 741. (6)

3. (a) Derive Total output offset voltage (V_{OOT}) due to input offset voltage (V_{io}) and input bias current Ib for a closed loop inverting amplifier. (6)

(b) Derive an expression for magnitude of gain and phase for open loop configuration of op amp using high frequency equivalent model. Also plot its frequency response. (6)

(c) Design a subtractor using operational amplifier in difference amplifier mode. (6)

4. (a) Derive the expression for output voltage of basic integrator using op-amp. What are the limitations of a basic integrator circuit? Explain with the help of circuit how do we overcome these limitations in a practical integrator. (6)

(b) Design an integrator circuit that can integrate a signal between frequency 1KHz to 10KHz. Also draw and explain its frequency response. (6)

(c) Design a circuit using operational amplifier to implement

$Vo = - (V_a + V_b + V_c + V_d) / 4$ (6)

5. (a) Draw the schematic diagram of a square wave generator and explain its working with respect to its output response. (6)

(b) Design a monostable multivibrator to be used as a divide by 2 frequency network. The frequency of the input trigger signal is 5kHz. Also draw its circuit. (6)

(c) Design a Phase Shift Oscillator to generate a wave of frequency 500Hz. Also draw its circuit. (6)

6. (a) Explain working of 555 timer in astable multivibrator mode using circuit. (6)

(b) Design a first-order high-pass filter having a cutoff frequency of 4 KHz and pass-band gain of 4. Draw its circuit and frequency response. (6)

(c) What is an all-pass filter? Derive the expression for its voltage gain and phase difference. Give its one application. (6)

7. (a) How is Schmitt trigger different from comparators? Explain the functioning of a Schmitt trigger. Derive expression for its hysteresis voltage equation. (6)

(b) Explain the functioning of non-inverting comparator? Draw necessary waveforms. Why limiter circuit is preferred over comparator? (6)

(c) Explain working of voltage limiter circuit with a p-n junction diode in its feedback path (Assume forward bias voltage drop as 0.7V). Draw output waveform with respect to input. Now replace p-n junction diode with zener diode and again draw output waveform with respect to input. (6)