6. (a) What are inverting and non-inverting amplifiers ? Derive for the closed loop voltage-gain (A_{VF}) for inverting and non-inverting amplifiers. **10**

(b) Draw the differentiator circuit using OP-AMP. And derive an expression for the output-voltage. **5**

7. Write short notes on any *three* of the following : **15**

(a) Flash type ADC.

(b) Single slope ADC.

(c) R-2R ladder DAC.

(d) Weighted resistor DAC.

Roll No. ..... **Total Pages : 04**

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May 2024

B. Tech. (ECE) (Fourth Semester)

Analog Circuits (EC-402)

Time : 3 *Hours*] [*Maximum Marks :* 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) What is trans-conductance amplifier ? **1.5**

(b) Give the advantages of using negative feedback in amplifier. **1.5**

(c) What are voltage multipliers ? **1.5**

(d) Give the merits and demerits of active filters over passive filters. **1.5**

(e) Give the advantages of differential amplifier. **1.5**

(f) What is Barkhausen criterion ? **1.5**

(g) Calculate the frequency of oscillations of a Hartly oscillator having L_1= 0.5 mh, L_2 = 1 mH and C_3 = 0.2 µF. **1.5**

(h) For a transformer coupled class-A power amplifier, the load resistance is 8Ω and the turns ratio of the transformer $N_1/N_2 = 64$. Calculate the reflected load resistance to the primary side. **1.5**

(i) For the inverting amplifier $R_1 = 1k\Omega$ and $R_f = 2M\Omega$. Assuming an ideal amplifier, determine voltage gain, input resistance and output resistance. **1.5**

(j) An 8-bit successive approximation ADC is driven by a 1MHz clock. Find the conversion time. **1.5**

Part B

2. (a) What is a half-wave rectifier ? Derive an expression for the efficiency of a half-wave rectifier. **10**

(b) Differentiate between voltage amplifier and current amplifier. **5**

3. (a) For a voltage series feedback type amplifier prove that the input impedence is increased due to the introduction of negative feedback. **5**

(b) Draw the circuit diagram of class-B push-pull amplifier and explain circuit operation and derive the expression for overall efficiency. **10**

4. Draw the circuit diagram of RC-Phase shift oscillator using a transistor and explain its circuit action. Derive an expression for frequency of oscillation. Design an RC-Phase shift oscillator using FET, to produce an output frequency of 1 kHz. V_{DD} =10V and JFET parameters are as follows : g_m = 4ms, V_p = – 4V, I_{DSS} = 10mA. **15**

5. (a) Define the terms for a differential amplifier : **5**

(i) Differential signal.

(ii) Common mode signal.

(iii) Differential gain.

(iv) Common mode gain.

(v) CMRR.

(b) What are current mirrors ? Where are these used ? Derive an expression for the maximum usable load, output resistance and minimum sustainable voltage for current mirrors. **10**