

Analog Electronics (313324)

MSBTE Diploma · K-Scheme · Model Question Paper — Set A

Time: 3 Hours**Max. Marks: 70****Instructions:**

1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Mobile phone, pager and any other electronic communication devices are not permissible in the examination hall.

Q.1 Attempt any FIVE of the following:**10**

- a) Classify power amplifiers on the basis of conduction angle and coupling.
- b) State the Barkhausen criteria for sustained oscillations.
- c) Define the following parameters of op-amp and write their typical values for IC 741: i) Slew rate ii) CMRR
- d) State the function of the level shifting stage in an op-amp.
- e) Define the following terms related to filters: i) Pass band ii) Roll-off rate
- f) Draw the labelled pin diagram of IC 555.
- g) Define lock range and capture range of a PLL.

Q.2 Attempt any THREE of the following:**12**

- a) Compare class A, class B, class AB and class C power amplifiers on the basis of: i) Conduction angle ii) Position of Q-point iii) Efficiency iv) Distortion
- b) Draw the block diagram of an op-amp and state the function of each block.
- c) Draw the circuit of RC phase shift oscillator using op-amp and explain its working. Write the formula for frequency of oscillation.
- d) IC 555 is used as an astable multivibrator with $R_A = 4.7 \text{ k}\Omega$, $R_B = 10 \text{ k}\Omega$ and $C = 0.01 \text{ }\mu\text{F}$. Calculate the frequency of oscillation and duty cycle. Draw the output waveform.

Q.3 Attempt any THREE of the following:**12**

- a) State the advantages and disadvantages of negative feedback in amplifiers.
- b) In an inverting amplifier $R_1 = 1 \text{ k}\Omega$, $R_F = 10 \text{ k}\Omega$ and $V_{in} = 0.5 \text{ V}$ (peak) sine wave at 1 kHz. Calculate the output voltage and sketch the input and output waveforms.
- c) Compare active filters and passive filters. (Any four points)

- d) Draw the circuit of class B complementary symmetry push-pull amplifier. Explain crossover distortion with waveforms.

Q.4 Attempt any THREE of the following:

12

- a) Draw the circuit of an op-amp integrator. Derive the expression for its output voltage and draw input-output waveforms.
- b) In an inverting Schmitt trigger, $R_1 = 1 \text{ k}\Omega$ (from non-inverting input to ground), $R_2 = 47 \text{ k}\Omega$ (from output to non-inverting input), $V_{\text{sat}} = \pm 13.5 \text{ V}$ and $V_{\text{in}} = 1 \text{ V}_{\text{p-p}}$ sine wave. Calculate V_{UT} , V_{LT} and hysteresis voltage V_{H} .
- c) Draw the ideal and practical frequency response of: i) Low pass filter ii) High pass filter
- d) Draw the block diagram of PLL and state the function of each block.
- e) Describe the working of a non-inverting zero crossing detector with circuit diagram and waveforms.

Q.5 Attempt any TWO of the following:

12

- a) Design a first order active low pass filter with cut-off frequency 1.5 kHz and pass band gain 2. Draw the designed circuit and its frequency response. (Assume $C = 0.01 \text{ }\mu\text{F}$)
- b) Draw the circuit of monostable multivibrator using IC 555 and explain its working with the help of internal block diagram and waveforms. Calculate the pulse width for $R = 47 \text{ k}\Omega$ and $C = 10 \text{ }\mu\text{F}$.
- c) Describe the working principle of Hartley oscillator using op-amp with circuit diagram. Derive the formula for its frequency of oscillation.

Q.6 Attempt any TWO of the following:

12

- a) Design a second order Butterworth high pass filter with cut-off frequency 5 kHz. Draw the designed circuit and sketch its actual frequency response. (Assume $C = 0.01 \text{ }\mu\text{F}$)
- b) Explain the use of PLL as FM demodulator with the help of block diagram.
- c) Draw and explain the sample and hold circuit using op-amp with input and output waveforms.

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in