

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023****Subject Code:3141002****Date:07-07-2023****Subject Name:Analog Circuit Design****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

| | | MARKS |
|------------|--|-----------|
| Q.1 | (a) Define PSRR, Slew Rate, and Output Offset voltage. | 03 |
| | (b) Draw the schematic diagram of the OP-AMP and its equivalent circuit. | 04 |
| | (c) Sketch the circuit of Phase-shift Oscillator using BJT and obtain its frequency of oscillation. | 07 |
| Q.2 | (a) Write short note on validity of hybrid- π model. | 03 |
| | (b) List the parameter those affecting to the transistor at high frequencies. | 04 |
| | (c) Derive the expression for the CE short-circuit current gain A_i as a function of frequency. | 07 |
| OR | | |
| | (c) Explain in detail the working principle of a crystal oscillator. | 07 |
| Q.3 | (a) What is feedback in amplifiers? Compare and contrast the effects of negative and positive feedback on amplifier performance. | 03 |
| | (b) With $g_m = 50 \text{ mA/V}$, $r_{b'e} = 1 \text{ K}$, $C_e = 1 \text{ pF}$ and $C_c = 0.2 \text{ pF}$, determine the values of f_β and f_T . | 04 |
| | (c) List and explain characteristics of amplifier which are modified by negative feedback. | 07 |
| OR | | |
| Q.3 | (a) The nominal gain (A_f) of an amplifier with feedback is 20, and a variation of 5% is permissible. If the magnitude of the return ratio ($A\beta$) is 1000, then determine the minimum value of the open loop gain (A) and the maximum permissible variation in it. | 03 |
| | (b) Draw the four types of feedback amplifier topologies. | 04 |
| | (c) Draw and explain triangular wave generator using OP-AMP | 07 |
| Q.4 | (a) What do you mean by Voltage regulator? List different types of voltage regulators. | 03 |
| | (b) Sketch the OP-AMP based sample-and-hold circuit and explain its operation. | 04 |

- (c) Sketch and explain the operation of an A-stable multivibrator based on a 555 timer? **07**

OR

- Q.4** (a) Briefly explain class A power amplifier. **03**
(b) Draw block diagram of Phase Locked Loop (PLL) and briefly explain its working. **04**
(c) Write a short-note on class-B push-pull power amplifier **07**

- Q.5** (a) Explain the difference between a band-stop filter and a band-pass filter. **03**
(b) With respect to filters define followings (i) Pass Band (ii) Stop Band (iii) Attenuation (iv) Cut-off frequency. **04**
(c) Write a short-note on Transformer Coupled Audio Power Amplifier **07**

OR

- Q.5** (a) 555 based A-stable multivibrator is constructed using the following components: **03**
 $C = 0.01 \mu\text{F}$, $R_1 = 10\text{K}\Omega$, $R_2 = 50\text{K}\Omega$.
Calculate the output frequency from the 555 oscillator and the duty cycle of the output waveform.
(b) How do active filters differ from passive filters? Briefly explain **04**
(c) Explain in detail Sallen-Key second-order low-pass filter. **07**
