

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER- IV EXAMINATION – SUMMER 2020****Subject Code: 2141002****Date: 27/10/2020****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.

		<b>MARKS</b>
<b>Q.1</b>	(a) Draw simplified internal block diagram of 555 Timer IC.	<b>03</b>
	(b) Draw and explain typical connection diagram of 78XX series voltage regulator. Also explain drop out voltage.	<b>04</b>
	(c) Derive the expression for the CE short-circuit current gain $A_T$ as a function of frequency.	<b>07</b>
<b>Q.2</b>	(a) Define followings: (i) Input offset voltage (ii) CMRR (iii) PSRR.	<b>03</b>
	(b) For Hybrid- $\pi$ transistor model $g_m = 50$ mA/V, $r_{b'e} = 1$ K, $C_e = 1$ pF, and $C_c = 0.2$ pF is given then determine the values of $f_\beta$ and $f_T$ .	<b>04</b>
	(c) Explain in detail transistor phase-shift oscillator and also derive expression for the frequency.	<b>07</b>
<b>OR</b>		
	(c) Draw Wien-bridge oscillator circuit and obtain its frequency of oscillation.	<b>07</b>
<b>Q.3</b>	(a) Draw and explain block diagram of typical OP-AMP.	<b>03</b>
	(b) List out characteristics of ideal OP-AMP.	<b>04</b>
	(c) What is Slew rate? What are its causes? Derive expression for maximum frequency of operation for desired output swing in terms of slew rate?	<b>07</b>
<b>OR</b>		
<b>Q.3</b>	(a) Draw equivalent circuit of an OP-AMP.	<b>03</b>
	(b) Write a brief note on emitter-coupled Differential Amplifier.	<b>04</b>
	(c) What is instrumentation amplifier? With help of neat diagram explain operation of Three OP-AMP based Instrumentation amplifier.	<b>07</b>
<b>Q.4</b>	(a) Briefly explain Inverting Amplifier in open loop mode.	<b>03</b>
	(b) Explain the circuit of voltage to current converter with floating load.	<b>04</b>
	(c) Draw and explain closed-loop differential amplifier with one OP-AMP and derive voltage gain equation.	<b>07</b>
<b>OR</b>		
<b>Q.4</b>	(a) Briefly explain operation of basic differentiator circuit.	<b>03</b>
	(b) Draw and explain OP-AMP based Voltage-shunt feedback amplifier. Derive closed-loop voltage gain equation for the same.	<b>04</b>
	(c) Explain in detail inverting Schmitt trigger circuit.	<b>07</b>
<b>Q.5</b>	(a) Briefly explain Peaking Amplifier.	<b>03</b>
	(b) With reference to filter design define following terms: (i) Pass band (ii) Stop band (iii) Attenuation (iv) Cut-off frequency	<b>04</b>
	(c) Show how Biquad circuit can be used as a universal filter?	<b>07</b>

**OR**

- Q.5** (a) Draw and explain briefly Zero crossing detector circuit. **03**
- (b) Design a first order low-pass filter for the following specifications: **04**  
(i) Passband voltage gain = 2 (ii) Cut-off frequency  $f_c = 10$  Khz.
- (c) With help of circuit diagram, explain operation of first order Butterworth low-pass filter. **07**

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