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**BTECH**  
**(SEM V) THEORY EXAMINATION 2024-25**  
**INTEGRATED CIRCUITS**

TIME: 3 HRS

M.MARKS: 100

**Note:** Attempt all Sections. In case of any missing data, choose suitably.

**SECTION A**

**1. Attempt all questions in brief.**

**2 x 10 = 20**

Q no.	Question	CO	Level
a.	Discuss the frequency response of IC 741 in brief.	1	K2
b.	Draw the short circuit protection circuitry of IC 741.	1	K 1
c.	Simulate an inductor of <b>1mH</b> using GIC.	2	K 3
d.	Discuss the effect of increasing the order of filter on its frequency response.	2	K 2
e.	Differentiate between comparator and Schmitt trigger.	3	K 4
f.	Differentiate between monostable and astable multivibrator.	3	K 4
g.	Define noise margin and propagation delay.	4	K 1
h.	Differentiate between level triggering and edge triggering.	4	K 2
i.	Calculate the frequency and duty cycle of IC 555 as astable multivibrator for <b>C = .01 μf, R<sub>A</sub> = 2.2 K</b> and <b>R<sub>B</sub> = 3.901 K</b>	5	K 3
j.	EXOR gate can be used as phase detector. Justify the statement.	5	K 5

**SECTION B**

**2. Attempt any three of the following:**

**10 x 3 = 30**

Q no.	Question	CO	Level
a.	Calculate the overall voltage gain provided by the IC 741 using small signal model.	1	K 3
b.	Discuss the instrumentation amplifier with proper circuit and mathematical expressions. Also discuss the advantages of instrumentation amplifier.	2	K 2
c.	Explain the followings: a) Comparator and zero crossing detector. b) Sample and Hold Circuit.	3	K 4
d.	Implement the following boolean expressions using CMOS a) $Y = \overline{(A + B)(C + DE)}$ b) $Y = \overline{(A + B)}$	4	K 3
e.	Explain the PLL along with its applications. Also define the lock range and capture range.	5	K 2

**SECTION C**

**3. Attempt any one part of the following:**

**10 x 1 = 10**

Q no.	Question	CO	Level
a.	Discuss the simplified model of IC 741. Hence derive the mathematical expression of slew rate and relation between slew rate and unity gain bandwidth.	1	K 2



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b.	Calculate the input impedance, output impedance and transconductance of input stage of IC 741 after completing the AC analysis.	1	K 2
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4. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Derive the transfer function of second order Sallen key low pass filter. Also design a low pass filter of cut off frequency of <b>1.5 KHz</b> and pass band gain of <b>10</b> .	2	K 3
b.	Derive transfer function of low pass, high pass and band pass filter using universal active filter of KHN Network.	2	K 3

5. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Discuss the generation of triangular wave using operation amplifier. Also derive mathematical expression for the frequency of generated triangular wave.	3	K 2
b.	Discuss the quadrant operation analog multiplier. Also discuss the operation of analog multiplier as phase detector.	3	K 2

6. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Discuss the implementation of S R Flip Flop using CMOS. Also discuss its simpler implementation.	4	K 2
b.	Discuss transfer characteristic of CMOS inverter through various region of operations of NMOS and PMOS.	4	K 2

7. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Explain the functioning of IC 555 as monostable multivibrator. Also derive the mathematical expression of pulse width.	5	K 4
b.	Explain the generation of square and triangular wave using IC 566 (VCO) through block diagram. Also derive the mathematical expression of frequency.	5	K 4