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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (2025-2026)

Subject: Analog Circuits

Time: 3 Hours

Max. Marks:100

General Instructions:

IMP: Verify that you have received question paper with correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION – A

20

1. Attempt all parts:-

- 1-a. In a two-stage RC-coupled amplifier, the overall lower cut-off frequency f_{L2} is --- 1
-----than single stage lower cut-off frequency f_L . (CO1, K1)
- (a) Lower
 - (b) Higher
 - (c) Equal
 - (d) None of these
- 1-b. The low frequency response of CE amplifier is similar to-----filter. (CO1, K1) 1
- (a) Low pass
 - (b) High pass
 - (c) Band pass
 - (d) Band stop
- 1-c. When negative feedback is applied to an amplifier with open-loop gain A and 1
feedback factor β , the closed-loop bandwidth: (CO2, K2)
- (a) decreases by a factor of $(1 + A\beta)$
 - (b) increases by a factor of $(1 + A\beta)$
 - (c) increases by β
 - (d) remains unchanged

- 1-d. Which of the following statements is TRUE for a Class-B power amplifier? (CO2, K2) 1
- (a) It has the best linearity among all classes
 - (b) It conducts for exactly one-half of the input cycle
 - (c) It has higher power dissipation than Class-A
 - (d) It is free from crossover distortion
- 1-e. In a Schmitt trigger, which type of feed-back is used? (CO3, K1) 1
- (a) Positive
 - (b) Negative
 - (c) Both positive and negative
 - (d) No feed back
- 1-f. An op-amp in inverting configuration uses $R_1 = 10\text{ k}\Omega$ and $R_f = 40\text{ k}\Omega$. The closed-loop gain is: (CO3, K2) 1
- (a) -4
 - (b) $+4$
 - (c) -0.25
 - (d) $+0.25$
- 1-g. The main advantage of a Wilson current mirror compared to a simple current mirror is: (CO4, K3) 1
- (a) Lower output resistance
 - (b) Higher dependence on transistor β
 - (c) Poor output current accuracy
 - (d) Higher output resistance
- 1-h. The Cascode current mirror uses ----- transistors. (CO4, K1) 1
- (a) 2
 - (b) 3
 - (c) 4
 - (d) 6
- 1-i. The Flip flop used in 555 Timer is----- (CO5, K4) 1
- (a) JK
 - (b) SR
 - (c) D
 - (d) T
- 1-j. For sustained oscillations, the Barkhausen criterion requires: (CO5, K2) 1
- (a) Loop gain = 0 and phase shift = 0°
 - (b) Loop gain > 1 and phase shift = 90°
 - (c) Loop gain = 1 and total phase shift = 0° or 360°
 - (d) Loop gain < 1 and total phase shift = 180°

2. Attempt all parts:-
- 2.a. Write the advantages of Cascode amplifier. (CO1, K1) 2
- 2.b. Compare power amplifiers on the basis of conduction angle. (CO2, K2) 2
- 2.c. Write the advantages of active filters. (CO3,K1) 2
- 2.d. Discuss the applications of current mirror. (CO4,K2) 2
- 2.e. Compare RC and LC Oscillators. (CO5, K2) 2

SECTION – B 30

3. Attempt all parts:-

3.a. Answer any one of the following-

- 3-a.i Explain the complete frequency response of CE amplifier. (CO1, K3) 6
- 3-a.ii Using the hybrid- π model, derive the expression for voltage gain A_v , input resistance R_{in} , and output resistance R_{out} of a common-emitter (CE) amplifier with emitter resistance R_E bypassed. (CO1, K3) 6

3.b. Answer any one of the following-

- 3-b.i A voltage-series negative feedback amplifier has an open-loop gain $A = 1000$, input resistance $R_i = 2 \text{ k}\Omega$, and output resistance $R_o = 10 \text{ k}\Omega$. A feedback network provides a feedback factor of $\beta = 0.01$. Calculate the closed-loop gain A_f , the new input resistance R_{if} , and the new output resistance R_{of} . (CO2, K3) 6
- 3-b.ii Discuss Cross over distortion in Class B Power amplifier, and explain how it can be eliminated? (CO2, K3) 6

3.c. Answer any one of the following-

- 3-c.i Explain the integrator circuit with applications. (CO3, K3) 6
- 3-c.ii What is super diode? With circuit diagram explain the operation of precision full wave rectifier. (CO3, K3) 6

3.d. Answer any one of the following-

- 3-d.i Discuss the primary characteristics of current mirror. (CO4, K3) 6
- 3-d.ii Derive the expression of current transfer ratio of Base-current compensated current mirror. (CO4, K3) 6

3.e. Answer any one of the following-

- 3-e.i Discuss the Astable multi-vibrator using IC 555 Timer. (CO5, K3) 6
- 3-e.ii With circuit diagram explain the Hartley oscillator. (CO5, K3) 6

SECTION – C 50

4. Answer any one of the following-

- 4-a. Derive the expression of A_M and f_H of CS amplifier using high frequency hybrid Π (Pi) model. (CO1, K3) 10
- 4-b. Show that the bandwidth of multistage amplifier is less than the bandwidth of single stage amplifier. (CO1, K4) 10

5. Answer any one of the following-

- 5-a. Draw the block diagram of negative feedback amplifier and discuss its advantages and disadvantages in details. (CO2, K3) 10
- 5-b. Explain the Class B Push-pull power amplifier and derive the expression of its efficiency. (CO2, K3) 10
6. Answer any one of the following-
- 6-a. Design second order Butterworth low pass and high pass filter with cut-off frequency 3 KHz. (CO3, K4) 10
- 6-b. Discuss the Differentiator circuit with applications. (CO3, K3) 10
7. Answer any one of the following-
- 7-a. Discuss the Wilson Current mirror with advantages and disadvantages. (CO4, K4) 10
- 7-b. For dual input balanced output differential amplifier derive the expression of A_d , A_c , R_{id} , R_{ic} and CMRR. (CO4, K4) 10
8. Answer any one of the following-
- 8-a. With circuit diagram explain RC phase shift oscillator in details. (CO5, K3) 10
- 8-b. With circuit diagram explain the Colpitts oscillator in details. (CO5, K3) 10