Reg. No.															

B.Tech. DEGREE EXAMINATION, JANUARY 2024
OPEN BOOK EXAMINATION
Fourth Semester

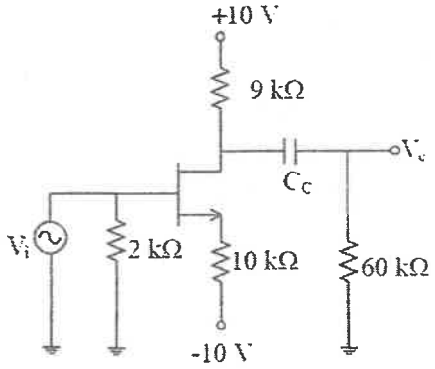
18ECC201J – ANALOG ELECTRONIC CIRCUITS
(For the candidates admitted from the academic year 2020-2021 to 2021-2022)

- Specific approved THREE text books (Printed or photocopy) recommended for the course
- Handwritten class notes (certified by the faculty handling the course / head of the department)

Time: 3 Hours | Max. Marks: 100

Answer **FIVE** questions
(Question No 1 is compulsory)

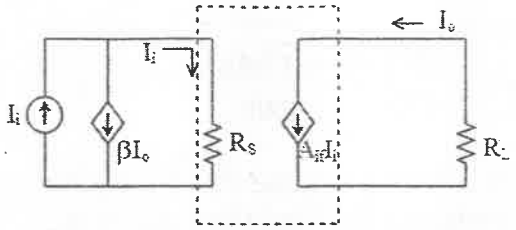
		Marks	BL	CO	PO
1.a.i.	Derive and determine the input resistance, output resistance and voltage gain of a BJT amplifier which has the maximum voltage gain and current gain with the following specifications. $\beta = 100, V_{BE} = 0.7\ V, R_1 = 2\ k\Omega, R_2 = 10\ k\Omega, R_C = 2.7\ k\Omega,$ $R_E = 0.4\ k\Omega, R_{Si} = 1\ k\Omega, C_1 = C_2 = 10\ \mu F, C_E = 1\ \mu F, V_{CC} = 15\ V$	12	3	1	3
ii.	Derive an expression for the voltage gain of a common-emitter amplifier by considering the effect of a coupling capacitor which couples the input signal to the amplifier.	6	2	1	2
b.	The overall decibel (dB) voltage gain of a multistage amplifier is (A) The DC voltage gain of the first stage (B) The product of the DC voltage gains of the individual stages (C) The sum of the voltage gains of the individual stages (D) The dB voltage gain of the last stage	1	1	1	1
c.	In emitter-follower circuit, the output resistance is _____ (A) High (B) Low (C) Very high (D) Moderate	1	1	1	1
2.a.i.	Derive and determine the input resistance, output resistance and voltage gain of a two-stage amplifier in which the overall voltage gain is the product of gain of individual stages with the following specifications. $V_{CC} = 10V, I_{CQ} = 100\ mA, \beta = 100, V_{BE} = 0.7\ V, V_A = 2, R_C = 10\ k\Omega, R_L = 100\ k\Omega$	12	3	1	3
ii.	Derive the small-signal current gain and input resistance of a multistage amplifier in which the overall current gain is the product of the current gain of individual stages.	6	2	1	2
b.	What is the use of coupling capacitors in common-emitter amplifier? (A) Blocks DC (B) Pass AC (C) Reduce distortion (D) Pass AC and blocks DC	1	1	1	1

c.	What is the total voltage gain of a cascading transistor configuration if the gain of first stage is 48 and the gain of the second stage is 12? (A) 6.75 (B) 6.55 (C) 576 (D) 565	1	2	1	2
3.a.i.	Derive and determine the input resistance, output resistance and voltage gain of a FET amplifier which produces 180° phase shift at the output, considering the following specifications. $V_{DD}=15\ V, V_{TN}=1.5\ V, K_n=1\ mA/V^2, \lambda=0.01\ V, R_{Si}=10\ k\Omega, R_1=50\ k\Omega,$ $R_2=22\ k\Omega, R_D=1\ k\Omega, \beta=100$	12	3	2	3
ii.	The circuit shown is to be used as a simple audio amplifier. Design the circuit such that the lower corner frequency is 100 Hz.  	6	2	2	2
b.	If $R_L \rightarrow \infty$ the voltage gain of a common-gate amplifier is _____ (A) Unity (B) Zero (C) Infinite (D) g_m	1	1	2	1
c.	What is the reason for connecting a capacitor in parallel with R_S? (A) It blocks the noise (B) To increase the impedance (C) For AC signal, it acts as a short circuit resulting in grounding the source terminal (D) It blocks the noise used for AC signal; it acts as a short circuit resulting in grounding the source terminal	1	1	2	1
4.a.i.	Illustrate the working of an oscillator circuit which consists of an equivalent capacitor in its tank circuit, with neat diagram and determine the frequency of oscillation considering the following specifications. $C_1=0.2\mu F, C_2=10\mu F, L=13mH$	12	3	3	3
ii.	Design and determine the frequency of oscillator which uses feedback network without any phase shift considering the following specifications. $C_1=250\ \mu F, C_2=250\ \mu F, R_1=220\ k\Omega$ *and* $R_2=220\ k\Omega, V_{CC}=15\ V$	6	2	3	2
b.	What is the phase shift produced by each RC section in an RC phase-shift oscillator? (A) 180° (B) 60° (C) 120° (D) 30°	1	1	3	1

c. Which of the following network is used in the feedback circuit of Hartley oscillator? 1 1 3 1

(A) Inductive fixed bias (B) Capacitive fixed bias
(C) Inductive voltage divider (D) Capacitive voltage divider

5.a.i. Identify the below feedback topology. Derive and determine its input impedance, output impedance and voltage gain of the feedback amplifier, considering the following specifications: 12 3 3 3
$R_i = 5\ k\Omega, R_0 = 10\ k\Omega, A = 100, \beta = 0.8$.



ii. Determine the output impedance of a voltage-series amplifier with the following specifications: β = 0.5, open-loop gain = 100, R_i = 5 kΩ, R_o = 10 kΩ. 6 2 3 2

b. When a negative feedback is employed in an amplifier, its bandwidth is _____ 1 1 3 1

(A) Increased (B) Decreased
(C) Infinite (D) Remains the same

c. When current feedback is employed in an amplifier, the input impedance is _____ 1 1 3 1

(A) Increased (B) Decreased
(C) Remains the same (D) Zero

6.a.i. A class-A power amplifier has zero-signal collector current of 100 mA. If the collector supply voltage is 5V, determine the following. 12 3 4 3

(1) Maximum AC output power
(2) Power rating of transistor
(3) Maximum collector efficiency

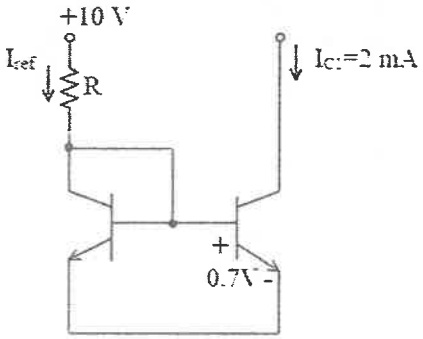
ii. Explain the working of a oscillator circuit which has the greater stability. 6 2 4 2

b. In class-AB operation of an amplifier, the output current flows for _____ 1 1 4 1

(A) Less than a half-cycle (B) Half-cycle
(C) More than a half-cycle but less than a full-cycle (D) Full-cycle

c. The crossover distortion in a class-B power amplifier can be eliminated by _____ amplifier. 1 1 4 1

(A) Class-A (B) Class-C
(C) Class-AB (D) Class-D

7.a.i.	Determine the following parameters for an amplifier producing output proportional to difference between the input signal, considering the following specifications. $V^+ = 10V, V^- = -10V, I_Q = 10mA, V_A = \infty, R_B = 15k\Omega$. Find (1) common-mode gain (A_C), (2) differential-mode gain (A_d), (3) CMRR, (4) A_d for one-sided input, and (5) CMRR in dB	12	3	5	3
ii.	Explain the operation of a current-source circuit which has larger output resistance with relevant equations.	6	2	5	2
b.	A Widlar current-source is used to get _____ (A) Low current (B) High CMRR (C) High output (D) Low gain	1	1	5	1
c.	For the current mirror circuit shown below, assume that the emitter area of a transistor Q_1 is equal to that of transistor Q_2. Find the value of R.  (A) 20 kΩ (B) 10 kΩ (C) 5 kΩ (D) 200 Ω	1	2	5	2

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