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B.Tech. DEGREE EXAMINATION, JULY 2022

Fourth Semester

18ECC201J – ANALOG ELECTRONIC CIRCUITS

(For the candidates admitted from the academic year 2020-2021 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours | Max. Marks: 75

PART – A (25 × 1 = 25 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
1.	What is the condition of I_C and V_{CE} to determine the cutoff and saturation point of DC load line? (A) $I_C = 5mA,\ V_{CE} = 0$ (B) $I_C = 0,\ V_{CE} = 0$ (C) $I_C = 0,\ V_{CE} = 10V$ (D) $I_C = Infinity,\ V_{CE} = 0$	1	2	1	2
2.	The two stage CC-CC amplifier is also called as _____ (A) Oscillator (B) Current buffer (C) Darlington pair (D) Phase shifter	1	1	1	1
3.	Find V_{th} and R_{th} of a voltage divider circuit having $V_{CC} = 18V,\ R_1 = 33K$ and $R_2 = 12K.$ (A) $V_{th} = 4.8V,\ R_{th} = 8.8K\Omega$ (B) $V_{th} = 5.8V,\ R_{th} = 9.8K\Omega$ (C) $V_{th} = 5.8V,\ R_{th} = 10.8K\Omega$ (D) $V_{th} = 6.8V,\ R_{th} = 7.8K\Omega$	1	2	1	2
4.	A certain cascaded amplifier arrangement has the following voltage gains $A_{V1} = 10,\ A_{V2} = 15,\ A_{V3} = 20.$ What is the overall voltage gain and voltage gain in dB? (A) 3000, 69.5 dB (B) 2000, 59.5 dB (C) 1000, 79.5 dB (D) 4000, 89.5 dB	1	2	1	2
5.	The transconductance g_m of a BJT hybrid π model is (A) $\frac{V_T}{r_0}$ (B) $\frac{I_{CQ}}{\beta f}$ (C) $\frac{V_T}{I_{CQ}}$ (D) $\frac{I_{CQ}}{V_T}$	1	1	1	1
6.	Find V_{gsQ} if $I_{DQ} = 1mA,\ K_n = 1mA/V^2,\ V_{tn} = 1V.$ (A) 1 V (B) 2V (C) 3 V (D) 4V	1	2	2	2
7.	Source follower can be used as (A) Phase shifter (B) Attenuator (C) Buffer (D) Oscillator	1	1	2	1
8.	When a common source amplifier is analysed using hybrid π model for high frequency response, the miller capacitance C_m is calculated as _____ (A) $C_m = 1 + g_m R_L$ (B) $C_m = C_{ds}(1 + g_m R_L).$ (C) $C_m = C_{gs}(1 + g_m R_L)$ (D) $C_m = C_{gd}(1 + g_m R_L)$	1	2	2	3
9.	Which of the following small signal equivalent circuit parameter of FET amplifier takes channel length modulation effect into consideration? (A) g_m (B) r_π (C) r_0 (D) V_{gsQ}	1	1	2	3
10.	What is the phase difference between the input signal and the output signal of a common gate amplifier? (A) 0° (B) 90° (C) 45° (D) 180°	1	1	2	1

11. Calculate the feedback transfer function β, if $A=10^5$ and $A_f=50$. 1 2 3 2

(A) 0.09 (B) 0.019
(C) 0.9 (D) 0.39

12. In a voltage series feedback amplifier, input impedance _____and output impedance _____by the factor of $(1+\beta A)$. 1 2 3 3

(A) decreases, decreases (B) increases, increases
(C) decreases, increases (D) increases, decreases

13. In Colpitt oscillator if $C_1=0.2\mu f$ and $C_2=0.02\mu f$, $f_{osc}=10KHz$, find the value of L_{eq}. 1 2 3 2

(A) 15.9 mH (B) 13.932 mH
(C) 14.9 mH (D) 12.93 mH

14. Which one of the following is used as audio frequency oscillator? 1 1 3 1

(A) Wein bridge oscillator (B) Hartley oscillator
(C) Colpitt oscillator (D) Crystal oscillator

15. Current series feedback amplifier is a _____ 1 1 3 3

(A) Transresistance amplifier (B) Current amplifier
(C) Voltage amplifier (D) Transconductance amplifier

16. The efficiency of Class B amplifier is _____ 1 1 4 3

(A) 50% (B) 100%
(C) 90% (D) 78.5%.

17. In a transformer coupled Class A power amplifier if $V_{CE(\max)}=15V$, $V_{CE(\min)}=1V$, find its overall efficiency. 1 2 4 2

(A) 43.75% (B) 53.75%
(C) 63.75% (D) 73.75%

18. Cross over distortion occurs in _____amplifier. 1 1 4 3

(A) Push-pull (B) Class A
(C) Class C (D) Class D

19. Calculate the effective resistance looking into the primary of a 15:1 transformer connected to an output load of $R_L=8\Omega$. 1 2 4 2

(A) $R_L'=2.8\Omega$ (B) $R_L'=1.8\Omega$
(C) $R_L'=0.8\Omega$ (D) $R_L'=2.8k\Omega$

20. What is the advantage of a Complementary Symmetry Push-Pull amplifier? 1 1 4 3

(A) No need of a resistor (B) Use of transformer
(C) Use of dual power supply (D) No need of transformer

21. _____current mirror is used as a current source. 1 1 5 1

(A) PMOS (B) NMOS
(C) CMOS. (D) BiCMOS

22. If output is measured between two collectors of BJT transistors, then the differential amplifier with two input signal is said to be configured as _____ 1 1 5 3

(A) Dual input, Balanced output (B) Dual input, Unbalanced output
(C) Single input, Balanced output (D) Dual input, Unbalanced output

23. Give the relationship between the output current (I_0) and the reference current (I_{ref}) of a BJT two transistor current mirror. 1 2 5 3

(A) $I_0=\dfrac{I_{ref}}{\left(\beta+\dfrac{2}{\beta}\right)}$ (B) $I_0=\dfrac{I_{ref}}{\left(1+\dfrac{2}{\beta}\right)}$

(C) $I_0=\dfrac{I_{ref}}{I_0\left(1+\dfrac{2}{\beta}\right)}$ (D) $I_0=\dfrac{\left(1+\dfrac{2}{\beta}\right)}{I_{ref}}$

		1	1	5	3

24. Mention the significance of the design of differential amplifier configuration.
(A) To increase the bias current (B) To reduce the power consumption
(C) To minimize the effect of common mode input signal (D) To increase the speed of operation.

		1	1	5	3

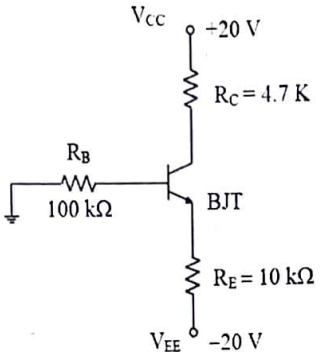
25. Active loads are essentially _____used in the place of resistive loads.
(A) voltage amplifiers. (B) transistor current sources
(C) Capacitors (D) Transformers

PART – B (5 × 10 = 50 Marks) | **Marks** | **BL** | **CO** | **PO**

Answer **ALL** Questions

		4	4	1	2

26. a.i. In the emitter bias circuit shown, determine the Q point for $\beta = 85$ and $V_{BE} = 0.7V$



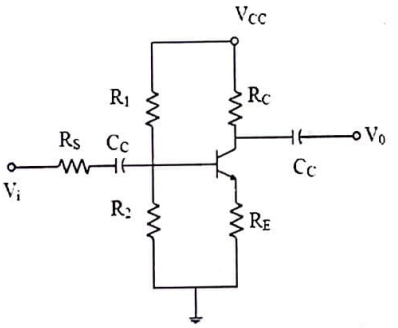
ii.		6	3	1	3

Draw the hybrid π model for a common collector amplifier and derive the expression for output impedance.

(OR)

		8	4	1	2

b.i. Consider a BJT common emitter amplifier given is the figure having $R_1 = 56k\Omega$, $R_2 = 12.2k\Omega$, $R_c = 2k\Omega$, $R_E = 0.4k\Omega$, $V_{cc} = 10V$, $V_{BE(ON)} = 0.7V$, $\beta = 100$, $V_A = \infty$, $R_s = 0.5k$. Calculate $r_\pi, g_m, r_o, R_{ib}, R_i$ and voltage gain A_V.



ii.		2	4	1	2

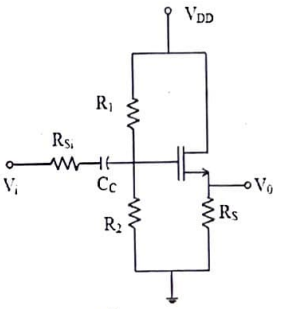
Calculate the cutoff frequency of a bipolar common emitter amplifier with a coupling capacitor having $R_1 = 51.2k\Omega$, $R_2 = 9.6k\Omega$, $r_\pi = 1.44k\Omega$, $\beta = 100$, $R_E = 0.4k\Omega$, $R_s = 0.1k\Omega$, coupling capacitor $C_C = 1\mu f$.

		5	3	2	3

27. a.i. Using small signal circuit of common gate amplifier, derive the voltage gain A_v.

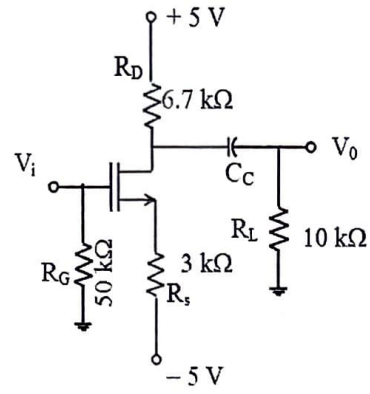
ii.		5	3	2	2

Calculate the small signal voltage gain of the source follower circuit given below. The circuit parameters are $V_{DD} = 12V$, $R_1 = 162k\Omega$, $R_2 = 463k\Omega$, $R_s = 0.75k\Omega$, $V_{Tn} = 1.5V$, $K_n = 4mA/V^2$, $\lambda = 0.01V^{-1}$ and $R_{si} = 4k\Omega$.

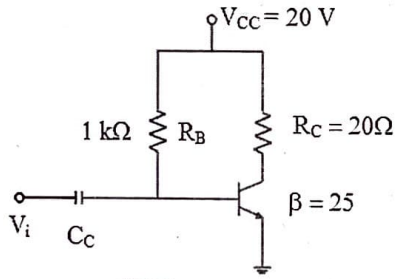


(OR)

b.i.	Derive the voltage gain of a common source amplifier with source resistance.	6	3	2	3
ii.	Determine the value of the coupling capacitor in the circuit given if $f_L = 20KHz$	4	4	2	2



28. a.i.	With necessary expressions, discuss the effect of negative feedback on gain, gain sensitivity, bandwidth and noise of an amplifier.	4	3	3	1
ii.	A voltage series negative feedback amplifier has a voltage gain without feedback of A=500, input resistance $R_i = 3k\Omega$, output resistance $R_0 = 20k\Omega$ and feedback ratio $\beta = 0.01$. Calculate the voltage gain A_f, input resistance R_{if}, and output resistance R_{of} of the amplifier with feedback.	6	3	3	2
	(OR)				
b.i.	Define Bharkausen criteria and explain the operation of a wein bridge oscillator and derive its frequency of oscillation.	8	3	3	3
ii.	Determine the frequency of oscillation of BJT RC phase shift oscillator if $R_1 = 25k\Omega$, $R_2 = 60k\Omega$, $R_c = 40k\Omega$, $R = 7.1k\Omega$, $h_{ie} = 1.8k\Omega$ and $C = 0.41nf$.	2	3	3	2
29. a.i.	Compare the operating characteristics of Class A, Class B, Class AB and Class C power amplifier.	4	3	4	1
ii.	Calculate the input power, output power and efficiency of the Class –A power amplifier given below.	6	3	4	2



(OR)

b.i.	Discuss briefly on the operation of class C power amplifier and write its efficiency expression.	3	3	4	3
ii.	Derive the efficiency of class B power amplifier and explain its push-pull configuration.	7	3	4	3
30. a.i.	Write short notes on BJT multi transistor current mirror and give its output current expression.	4	3	5	3
ii.	Discuss the operation of FET two transistor current source and derive its output current.	6	3	5	3
	(OR)				
b.i.	With neat diagrams and necessary expressions, explain the operation of basic BJT differential amplifier and its small signal equivalent circuit.	8	3	5	3
ii.	Draw the circuit diagram of BJT differential amplifier with active load and write its differential gain expression.	2	3	5	3

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