University of Mumbai

Examination 2021 under Cluster 06

(Lead College: Vidyavardhini's College of Engg Tech)

Examinations Commencing from June 01, 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev 2019

Examination: SE Semester IV

Course Code: ELC402 and Course Name: Electronic Devices and Circuits-II

Time: 2 hour Max. Marks: 80

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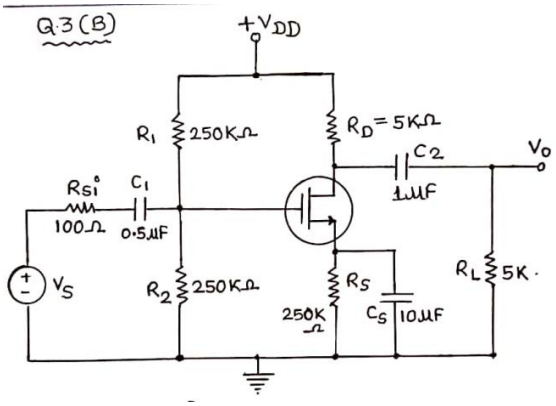
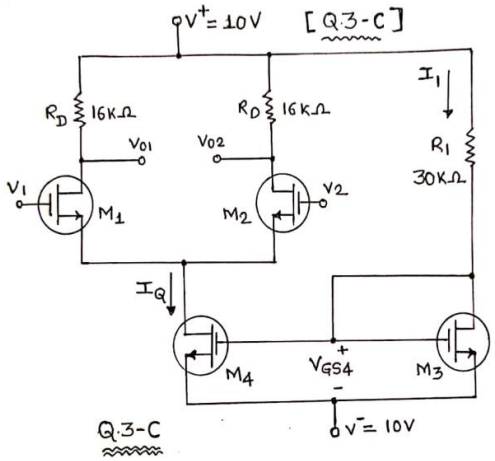
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Which capacitors assists in preventing the loss of gain due to negative feedback without affecting the DC stability of R-C Coupled amplifier?
Option A:	Coupling capacitors (Cc)
Option B:	Bypass capacitors (Cs)
Option C:	Internal Capacitance Cgd
Option D:	Internal Capacitance Cgs
2.	An amplifier has an input signal voltage of 0.054 mV. The output voltage is 12.5 V. The voltage gain in dB is….
Option A:	53.6 dB.
Option B:	107.3 dB.
Option C:	231 dB.
Option D:	116 dB.
3.	A certain amplifier has a bandwidth of 22.5 kHz with a lower cutoff frequency of 600 Hz. What is the value of upper cut-off frequency?
Option A:	600 Hz
Option B:	22.5 kHz
Option C:	23.1 kHz
Option D:	21.9 kHz
4.	In Current Shunt Negative feedback topology….....
Option A:	Ri Increases and Ro Decreases
Option B:	Ri Increases and Ro Increases
Option C:	Ri Decreases and Ro Decreases
Option D:	Ri Decreases and Ro Increases
5.	An amplifier has a Rin = 1.2 kΩ. The coupling capacitor is 1 µF. Determine the approximate lower cutoff frequency.
Option A:	132.62 Hz
Option B:	1.33 kHz
Option C:	13.3 kHz
Option D:	133.55 kHz
6.	The gain of an amplifier without feedback is 100 db. If a negative feedback of 3 db is applied, the gain of the amplifier will become ……..

Option A:	5 db
Option B:	300 db
Option C:	103 db
Option D:	97 db
7.	In Voltage Shunt Negative feedback topology….....
Option A:	Ri Increases and Ro Decreases
Option B:	Ri Increases and Ro Increases
Option C:	Ri Decreases and Ro Decreases
Option D:	Ri Decreases and Ro Increases
8.	If a three-stage amplifier has individual stage gains of 10 db, 5 db and 12 db, then total gain in db is …….
Option A:	600 db
Option B:	24 db
Option C:	14 db
Option D:	27 db
9.	The frequency of oscillations in an LC oscillator is ……. L or C.
Option A:	Inversely proportional to square root of
Option B:	Directly proportional to
Option C:	Proportional to square of
Option D:	Independent of the values of
10.	The total gain of a multistage amplifier is less than the product of the gains of individual stages due to …….
Option A:	Power loss in the coupling device
Option B:	Loading effect of the next stage
Option C:	The use of many transistors
Option D:	The use of many capacitors
11.	If, $\Theta JC=1.5\ ^0C/W$, $\Theta CS=1\ ^0C/W$, $\Theta SA=4\ ^0C/W$, $\Theta CA=50\ ^0C/W$, $T_{JMax}=100\ ^0C$ and $T_{AMB}=25\ ^0C$, then Maximum power dissipation with and without Heat Sink will be…..
Option A:	16.75W, 2.45W
Option B:	18.75W, 1.45W
Option C:	20.75W, 3.45W
Option D:	19.25W, 2.45W
12.	Phase shift provided by each one phase shift network in RC Phase Oscillator in 3 stage RC network is ……
Option A:	90 degrees
Option B:	180 degrees
Option C:	60 degrees
Option D:	120 degrees
13.	Maximum Power Conversion Efficiency of transformed coupled Class-A Power Amplifier is……..
Option A:	75%
Option B:	25%

Option C:	50%
Option D:	100%
14.	In Class-B Power Amplifier, Q-Point is located at…….
Option A:	Cut-off Point
Option B:	Saturation Point
Option C:	Middle of the DC Load Line
Option D:	After Cut-off Point
15.	If a power amplifier having zero signal power dissipation of 5 watts and a.c. power output of 2 watts, What will be the collector efficiency?
Option A:	20%
Option B:	40%
Option C:	80%
Option D:	50%
16.	What is the meaning of Dual Input Balanced Output?
Option A:	Output is measured between collectors of any one transistor and the Differential amplifier with two input signals
Option B:	Output is measured between two collectors of transistors and the Differential amplifier with two input signals
Option C:	Output is measured between collector of first transistor and the Differential amplifier with two input signals
Option D:	Output is measured between collector of second transistor and the Differential amplifier with two input signals
17.	A Differential Amplifier should have collector resistor's value (RC1 & RC2) as….
Option A:	10kΩ ,15kΩ
Option B:	15kΩ ,10kΩ
Option C:	15kΩ ,15kΩ
Option D:	15Ω ,15kΩ
18.	The value of emitter resistance in Emitter Biased circuit are RE1=25kΩ & RE2=20kΩ. Find RE
Option A:	45kΩ
Option B:	11.11kΩ
Option C:	5.11kΩ
Option D:	100kΩ
19.	One of the most important condition to get sustained oscillation is ……
Option A:	A phase shift around the feedback loop of 0 degree or 360 degree
Option B:	A phase shift around the feedback loop of 180 degree
Option C:	A gain around the feedback loop of one-third
Option D:	A gain around the feedback loop of less than 1
20.	Why the size of Power MOSFET is made considerably large?
Option A:	To provide easy handling
Option B:	To dissipate Maximum Heat
Option C:	To get maximum Efficiency
Option D:	To facilitate connections

Q2 **(20 Marks)**	**Solve any Four Questions out of Six** **05 Marks each**
A	Explain high frequency equivalent circuit of MOSFET.
B	Draw and explain the working principle of CASCODE amplifier using MOSFET.
C	What are the advantages and dis-advantages of negative feedback?
D	State and explain Barkhausen's criterion.
E	Draw the MOSFET differential amplifier with active load.
F	Draw and explain the working of Class-AB output stage with diode biasing

Q3 **(20 Marks)**	**Solve any Two Questions out of Three** **10 marks each**
A	Draw transformer coupled Class-A Power amplifier and load line, derive the maximum power conversion efficiency for the same.
B	For the CS MOSFET amplifier shown in figure below, calculate the values of f_H and f_L. Assume the following values for the MOSFET. Cgd=2pF, Cgs=5pF, Rsi=100Ω, gm=10mS, C_1=0.5μF, C_2=1μF, Cs=10μF, R_1=R_2=250kΩ , R_D=5kΩ, R_S=250kΩ and R_L=5kΩ 
C	For the MOSFET differential amplifier, the transistor parameters are K_{n1}=K_{n2}=0.1mA/V^2, K_{n3}=K_{n4}=0.3mA/V^2, V_{TN}=1V for all MOSFET's. λ=0 for M1, M2 and M3 and λ=0.01V^{-1} for M4. Determine the bias current I_Q, O/P resistance of current source, Ad, A_{CM} and CMRR 

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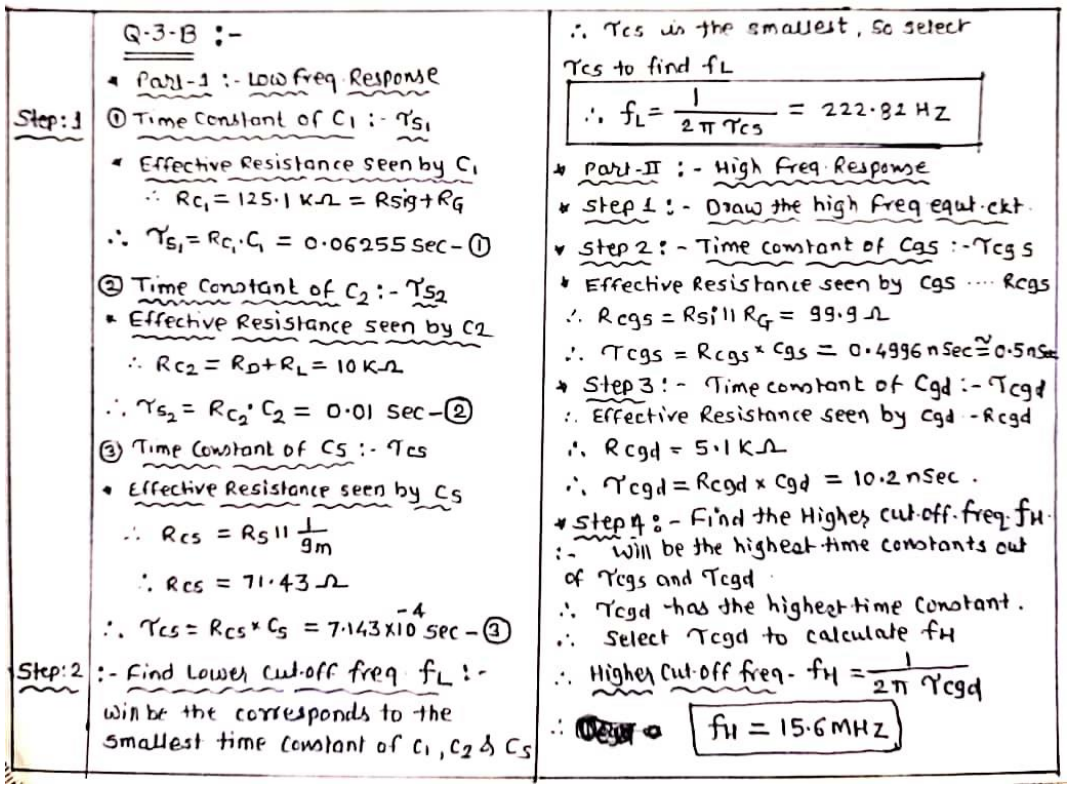
Q1:

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	B
Q2.	B
Q3.	C
Q4	D
Q5	A
Q6	D
Q7	C
Q8.	D
Q9.	A
Q10.	B
Q11.	B
Q12.	C
Q13.	C
Q14.	A
Q15.	B
Q16.	B
Q17.	C
Q18.	B
Q19.	A
Q20.	B

Important steps and final answer for the questions involving numerical example

Q3(B):



Q-3-B :-

Step: 1

- Part-1 :- Low freq Response
- ① Time Constant of C_1 :- τ_{s_1}
- Effective Resistance seen by C_1
- $\therefore R_{c_1} = 125.1\ K\Omega = R_{sig} + R_G$
- $\therefore \tau_{s_1} = R_{c_1} \cdot C_1 = 0.06255\ sec$ – ①
- ② Time Constant of C_2 :- τ_{s_2}
- Effective Resistance seen by C_2
- $\therefore R_{c_2} = R_D + R_L = 10\ K\Omega$
- $\therefore \tau_{s_2} = R_{c_2} \cdot C_2 = 0.01\ sec$ – ②
- ③ Time Constant of C_S :- τ_{cs}
- Effective Resistance seen by C_S
- $\therefore R_{cs} = R_S \,||\, \frac{1}{g_m}$
- $\therefore R_{cs} = 71.43\ \Omega$
- $\therefore \tau_{cs} = R_{cs} \times C_S = 7.143 \times 10^{-4}\ sec$ – ③

Step: 2 :- Find Lower cut-off freq f_L :- will be the corresponds to the smallest time constant of C_1, C_2 & C_S

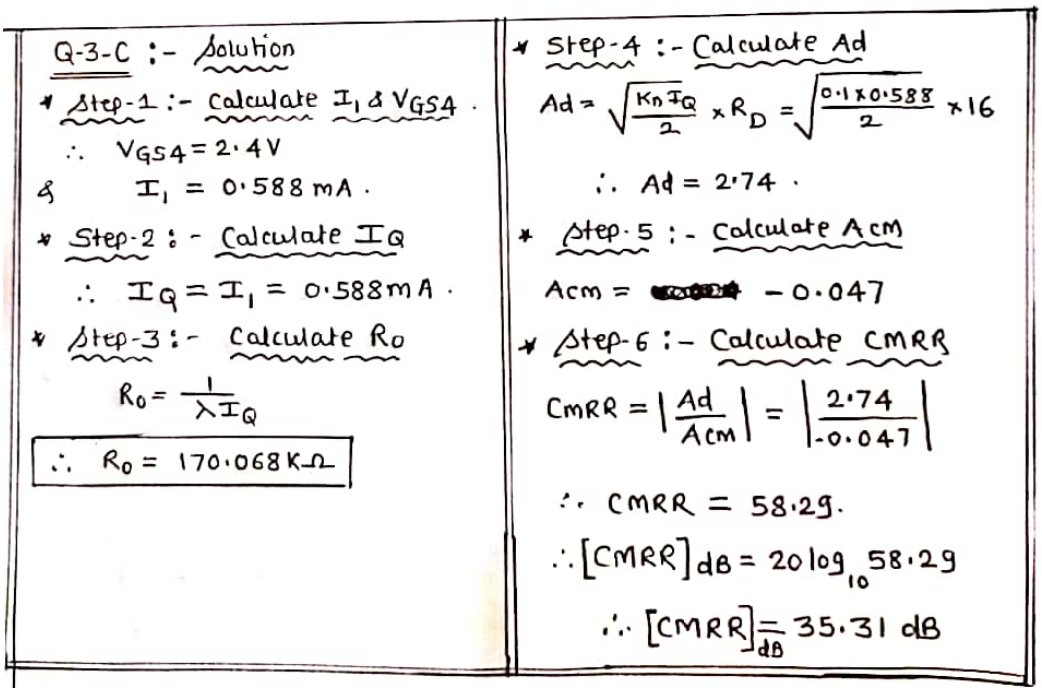
$\therefore \tau_{cs}$ is the smallest, so select τ_{cs} to find f_L

$$\therefore f_L = \frac{1}{2\pi \tau_{cs}} = 222.82\ Hz$$

- Part-II :- High Freq Response
- Step 1 :- Draw the high freq equt. ckt.
- Step 2 :- Time constant of C_{gs} :- τ_{cgs}
- Effective Resistance seen by C_{gs} ..... R_{cgs}
- $\therefore R_{cgs} = R_{sig} \,||\, R_G = 99.9\ \Omega$
- $\therefore \tau_{cgs} = R_{cgs} \times C_{gs} = 0.4996\ nSec \cong 0.5\ nSec$
- Step 3 :- Time constant of C_{gd} :- τ_{cgd}
- $\therefore$ Effective Resistance seen by C_{gd} - R_{cgd}
- $\therefore R_{cgd} = 5.1\ K\Omega$
- $\therefore \tau_{cgd} = R_{cgd} \times C_{gd} = 10.2\ nSec$.
- Step 4 :- Find the Higher cut-off freq f_H :- Will be the higher time constants out of τ_{cgs} and τ_{cgd}
- $\therefore \tau_{cgd}$ has the higher time constant.
- $\therefore$ Select τ_{cgd} to calculate f_H
- $\therefore$ Higher Cut-off freq - $f_H = \frac{1}{2\pi \tau_{cgd}}$

$$\therefore f_H = 15.6\ MHz$$

Q3(C):



Q-3-C :- Solution

- Step-1 :- Calculate I_1 & V_{GS4}.
- $\therefore V_{GS4} = 2.4\ V$
- & $I_1 = 0.588\ mA$.
- Step-2 :- Calculate I_Q
- $\therefore I_Q = I_1 = 0.588\ mA$.
- Step-3 :- Calculate R_O

$$R_O = \frac{1}{\lambda I_Q}$$

$$\therefore R_O = 170.068\ K\Omega$$

- Step-4 :- Calculate Ad

$$A_d = \sqrt{\frac{K_n I_Q}{2}} \times R_D = \sqrt{\frac{0.1 \times 0.588}{2}} \times 16$$

$$\therefore A_d = 2.74$$

- Step-5 :- Calculate A_{cm}

$A_{cm} =$ [redacted] -0.047

- Step-6 :- Calculate CMRR

$$CMRR = \left|\frac{A_d}{A_{cm}}\right| = \left|\frac{2.74}{-0.047}\right|$$

$$\therefore CMRR = 58.29.$$

$$\therefore [CMRR]_{dB} = 20 \log_{10} 58.29$$

$$\therefore [CMRR]_{dB} = 35.31\ dB$$