University of Mumbai
Examination 2021 under Cluster 06
(Lead College: Vidyavardhini's College of Engg Tech)
Examinations Commencing from 15th June 2021
Program: **Electronics Engineering**
Curriculum Scheme: Rev 2019
Examination: SE Semester III
Course Code: ELC302 and Course Name: Electronic Devices and Circuits I
Time: 2 hour Max. Marks: 80

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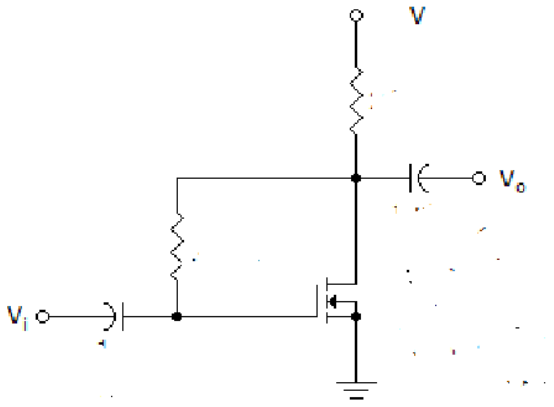
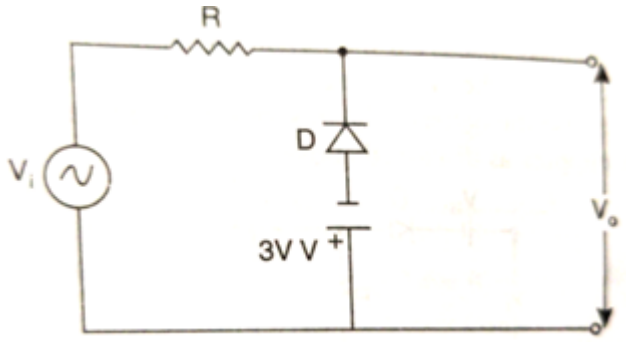
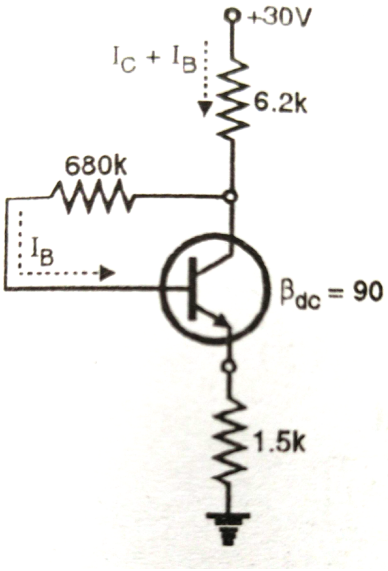
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	The transition capacitance C_T of PN junction diode decreases
Option A:	With decrease in the reverse voltage
Option B:	With decrease in the forward voltage
Option C:	With increase in the reverse voltage
Option D:	With increase in the forward voltage
2.	Fermi energy level for n-type semiconductors lies ----------and P type semiconductor lies ----------
Option A:	Close to conduction band, Close to valence band
Option B:	Close to conduction band, Close to conduction band
Option C:	Close to valence band, Close to conduction band
Option D:	Close to valence band, Close to valence band
3.	When a PN junction diode is operated in the forward biased mode , an increased in temperature results in
Option A:	Increase in forward voltage
Option B:	decrease in forward voltage
Option C:	Forward voltage remains same
Option D:	Forward voltage becomes infinite
4.	In the construction of Schottky diode,
Option A:	A PN junction is formed between p type semiconductor and N type semiconductor material.
Option B:	A Metal semiconductor junction is formed between a metal and N type semiconductor material.
Option C:	A Metal Oxide junction is formed between a metal and SiO2 material.
Option D:	An insulator semiconductor junction is formed between an insulator and P type semiconductor material.
5.	Name the device in which energy is released in the form of light when the recombination of electrons and holes takes place.
Option A:	Zener diode
Option B:	Solar cell
Option C:	LED
Option D:	Photodiode
6.	Name the device which is always operated in reverse bias condition.

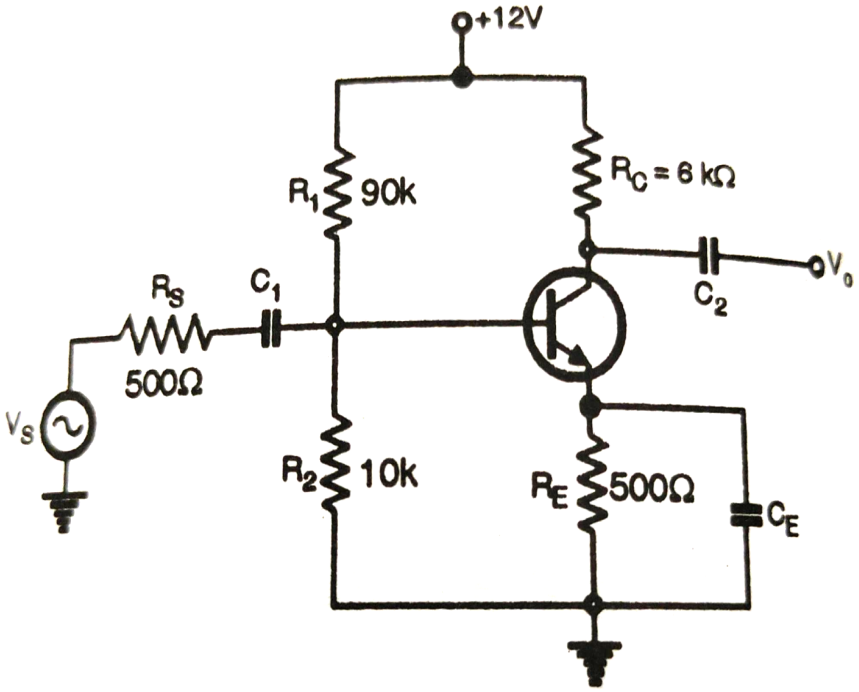
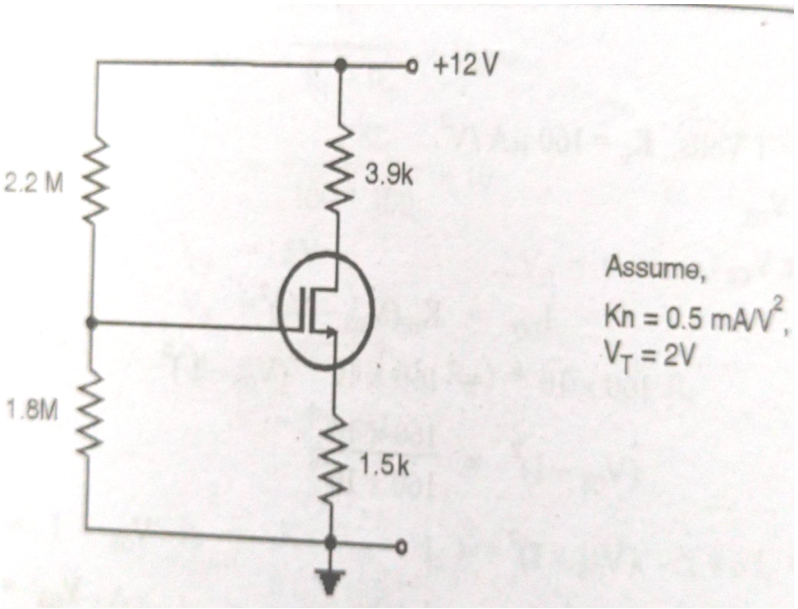
Option A:	Schottky diode
Option B:	Solar cell
Option C:	LED
Option D:	Photodiode
7.	In fixed bias circuit using an NPN transistor, if VCC =12V, VBE=0.7V, Base resistor RB= 100 k then I_B is
Option A:	80 µA
Option B:	113 µA
Option C:	130 µA
Option D:	130 mA
8.	Which Configuration has a high input impedance and low output impedance
Option A:	Common Base Configuration
Option B:	Common Collector Configuration
Option C:	Common Emitter Configuration
Option D:	Collector Emitter Configuration
9.	The emitter current in transistor
Option A:	is almost equal to leakage current
Option B:	is equal to base current
Option C:	is equal to difference between base current and collector current
Option D:	is equal to sum of base current and collector current
10.	The value of current gain β in CE Configuration, is -------- as compared to the current gain α in CB Configuration
Option A:	lower
Option B:	higher
Option C:	Same
Option D:	zero
11.	Hybrid π model consists of parameters such as
Option A:	small signal resistance r_π and a dependent current source gmVπ
Option B:	input impedance, reverse voltage gain, current gain and output conductance
Option C:	small signal resistance re and a controlled current source
Option D:	small signal resistance r_π and an independent current source gmVπ

12.	 Identify biasing circuit
Option A:	DMOSFET fixed bias circuit.
Option B:	EMOSFET Voltage divider bias circuit.
Option C:	EMOSFET feedback biasing circuit
Option D:	Collector to base bias circuit.
13.	In case of JFET, tranconductance gm is given by,
Option A:	gm=Ic/Vt
Option B:	gm= 2Kn(Vgs-Vt)
Option C:	gm=gmo[1-(Vgs/Vp)]
Option D:	gm=Va/Ic
14.	The N channel connecting two N regions is absent in
Option A:	N channel DMOSFET
Option B:	N channel EMOSFET
Option C:	P channel DMOSFET
Option D:	P channel EMOSFET
15.	The input impedance of the MOSFET is very high .Give reason
Option A:	The SiO_2 layer is present between gate terminal and channel.
Option B:	Metallic contacts are used for connecting the Drain, gate and source terminals.
Option C:	A P type semiconductor is used as a substrate
Option D:	A N type semiconductor is used as a substrate.
16.	In a N channel EMOSFET when a gate-to-source voltage Vgs is 0 V then value of drain current is
Option A:	Maximum
Option B:	infinite
Option C:	zero
Option D:	drain current does not depend on Vgs
17.	The ripple factor of C Filter is decreases by
Option A:	Increasing with the load resistance
Option B:	decreasing with the load resistance
Option C:	Does not depend on the load resistance
Option D:	has the lowest value
18.	In a center tap full wave rectifier, the value of the average load current I_{LDC} is

Option A:	I_m/π
Option B:	$2\ I_m/\pi$
Option C:	$I_m/2$
Option D:	$I_m/\sqrt{2}$
19.	Reactance of capacitor is given by
Option A:	Xc= 1/2 π f C
Option B:	Xc= 1/2 π R C
Option C:	Xc= 1 / 2 π L C
Option D:	Xc= 1/ 2 π R L
20.	In the design steps for RC coupled CE amplifiers, the voltage drop across emitter resistor R_E should be ---------- as compared to base emitter voltage of transistor.
Option A:	lower
Option B:	higher
Option C:	same
Option D:	zero

Q2. (20 Marks)	**Solve any Four out of Six . 5 marks each**
A	Draw and explain the small signal model of a PN Junction diode.
B	Sinusoidal waveform of 10 V peak to peak is applied at input signal Vi. Biased voltage V= 3V. Identify this circuit and Draw the input and output waveforms for the given circuit. 
C	Draw and explain the construction of solar cell. What is the array of solar cell?
D	Explain the operation of Bridge type full wave rectifier and draw the output waveform for V_{LDC} and I_{LDC}.
E	Compare C and L filters.
F	Draw Energy band diagram of PN junction diode under Forward biased, Reverse biased and Zero biased .

Q3. (20 Marks)	**Solve any Two Questions out of Three.** **10 marks each**
A	For the given circuit calculate I_{BQ},I_{CQ} and V_{CEQ}  Here VCC=30V,RB=680K,B=90,RC=6.2K,RE=1.5K
B	For the given circuit, calculate 1)Voltage gain AVs 2)input resistance 3)output resistance β= 100,VA=100 and VBE=0.7 V

	
C	For the given circuit calculate Q point co-ordinates(VGSQ, IDQ ,VDSQ) 

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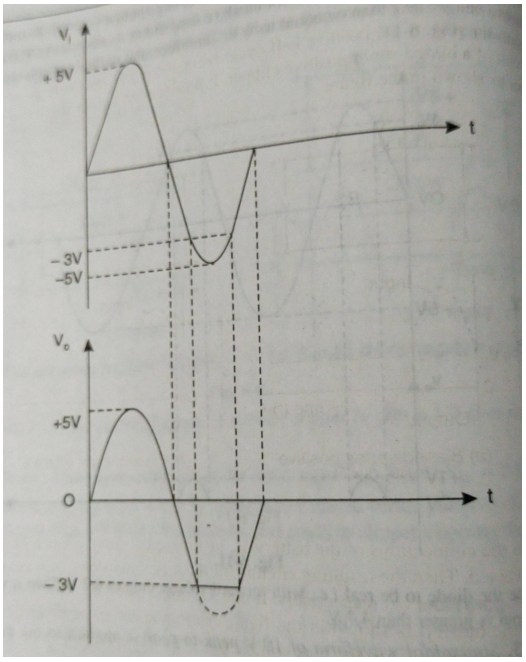
Q1:

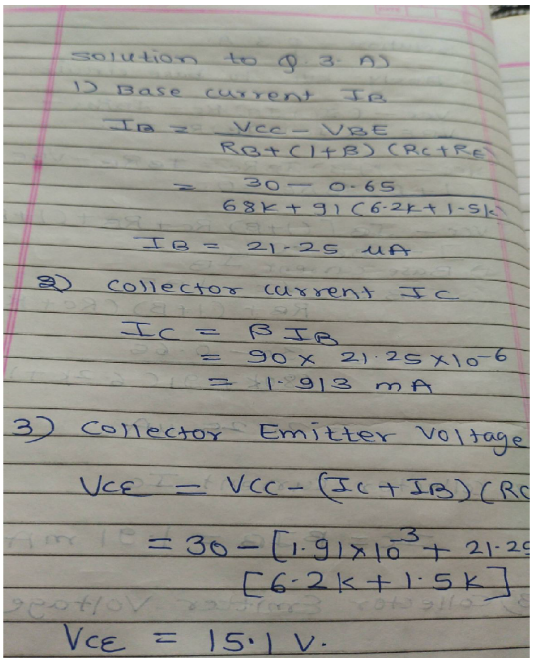
Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	C
Q2.	A
Q3.	B
Q4	B
Q5	C
Q6	D
Q7	B
Q8.	B
Q9.	D
Q10.	B
Q11.	A
Q12.	C
Q13.	C
Q14.	B
Q15.	A
Q16.	C
Q17.	A
Q18.	B
Q19.	A
Q20.	B

Important steps and final answer for the questions involving numerical example

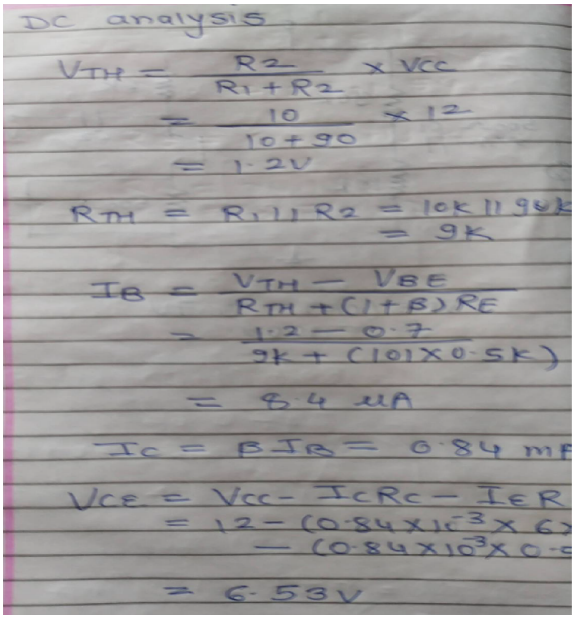
Q2(B):This is a biased negative shunt clipper circuit.

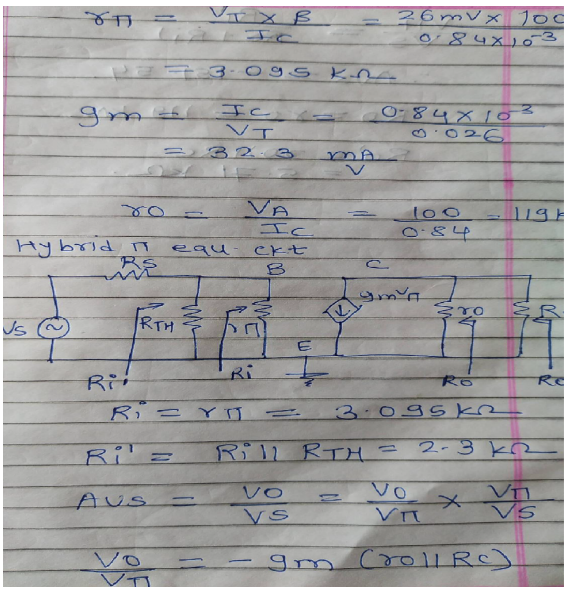


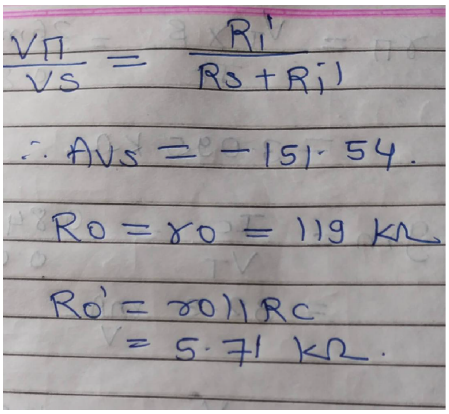
Q.3 A)



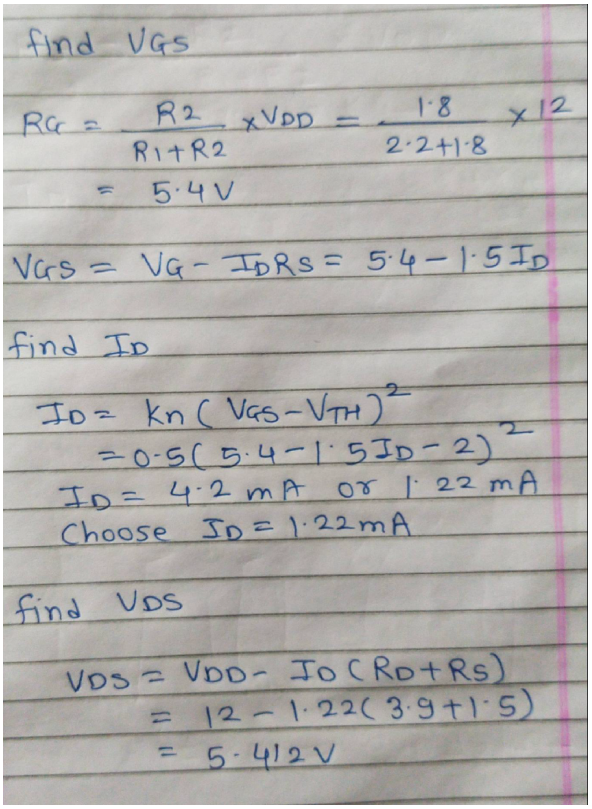
Q. 3 B)


DC analysis
$V_{TH} = \frac{R_2}{R_1+R_2} \times V_{CC}$
$= \frac{10}{10+90} \times 12$
$= 1.2V$
$R_{TH} = R_1 \| R_2 = 10k \| 90k$
$= 9k$
$I_B = \frac{V_{TH} - V_{BE}}{R_{TH} + (1+\beta)R_E}$
$= \frac{1.2 - 0.7}{9k + (101 \times 0.5k)}$
$= 8.4\ \mu A$
$I_C = \beta I_B = 0.84\ mA$
$V_{CE} = V_{CC} - I_C R_C - I_E R$
$= 12 - (0.84 \times 10^{-3} \times 6$
$- (0.84 \times 10^{-3} \times 0.5$
$= 6.53V$


$r_\pi = \frac{V_T \times \beta}{I_C} = \frac{26mV \times 100}{0.84 \times 10^{-3}}$
$= 3.095\ K\Omega$
$g_m = \frac{I_C}{V_T} = \frac{0.84 \times 10^{-3}}{0.026}$
$= 32.3\ \frac{mA}{V}$
$r_o = \frac{V_A}{I_C} = \frac{100}{0.84} = 119$
Hybrid π equ ckt
R_S
B
C
$g_m V_\pi$
r_o
V_S
R_{TH}
r_π
E
R_i'
R_i
R_O
$R_i = r_\pi = 3.095 K\Omega$
$R_i' = R_i \| R_{TH} = 2.3 K\Omega$
$A_{VS} = \frac{V_O}{V_S} = \frac{V_O}{V_\pi} \times \frac{V_\pi}{V_S}$
$\frac{V_O}{V_\pi} = -g_m (r_o \| R_C)$


$\frac{V_\pi}{V_S} = \frac{R_i'}{R_S + R_i'}$
$\therefore A_{VS} = -151.54$
$R_O = r_O = 119\ K\Omega$
$R_O' = r_O \| R_C$
$= 5.71\ K\Omega$

Q.3 C)



find V_{GS}

$$R_G = \frac{R_2}{R_1+R_2} \times V_{DD} = \frac{1.8}{2.2+1.8} \times 12$$

$$= 5.4\,V$$

$$V_{GS} = V_G - I_D R_S = 5.4 - 1.5 I_D$$

find I_D

$$I_D = k_n (V_{GS} - V_{TH})^2$$

$$= 0.5(5.4 - 1.5 I_D - 2)^2$$

$I_D = 4.2\,mA$ or $1.22\,mA$

Choose $I_D = 1.22\,mA$

find V_{DS}

$$V_{DS} = V_{DD} - I_D (R_D + R_S)$$

$$= 12 - 1.22(3.9 + 1.5)$$

$$= 5.412\,V$$