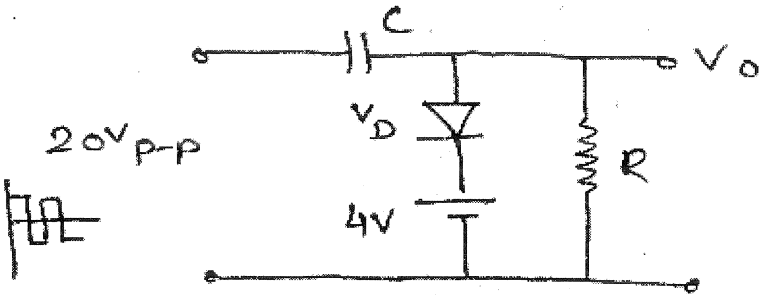
[3 Hours] **[Total Marks : 80]**

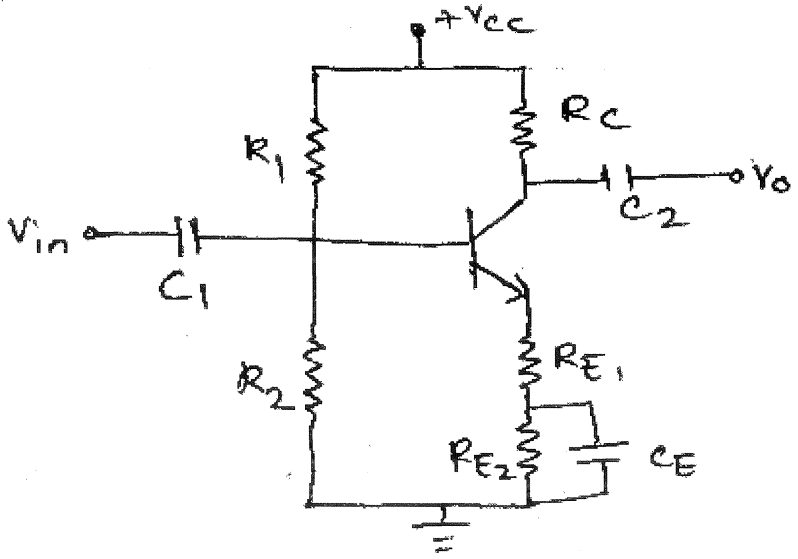
N.B : 1. Question No. **1** is **compulsory**.
2. Attempt any **three** questions out of remaining **five** questions.
3. Assume suitable data if necessary.

1. (a) Explain working of BJT as a switch. **5**
(b) Explain why FET is called as voltage controlled device. **5**
(c) Compare D-MOSFET and E-MOSFET. **5**
(d) Draw High frequency BJT and FET equivalent model. **5**

2. (a) Explain zero temperature drift in FET. **5**
(b) For the following circuit, draw the output waveform. $V_D = 0{\cdot}5V$ **5**



(c) For the following circuit, Vcc = 15V. Calculate **10**
(i) Q-point (ii) A_V (iii) Z_i (iv) Z_o
Given : $\beta = 90$



Given $R_1 = 56\ K\Omega$, $R_2 = 8{\cdot}2\ K\Omega$, $R_{E1} = R_{E2} = 750\ \Omega$
$R_C = 6{\cdot}8\ K\Omega$, $C_1 = 1\ \mu F$, $C_2 = 10\ \mu F$, $C_E = 47\ \mu F$

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3. (a) Design a single state RC coupled CE Amplifier to meet the following specifications. **16**
Use BC147B.
$|Av| \geq 150$, $f_L = 20$ Hz, $S \leq 10$, V_O (rms)= 3V

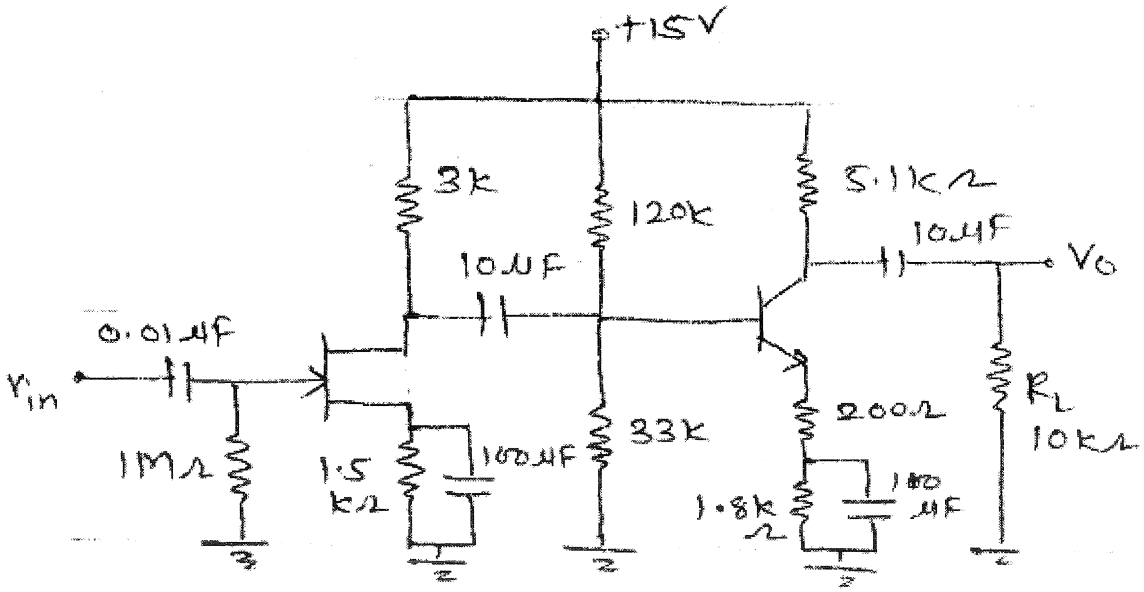
(b) For the above design circuit calculate A_V, Z_i and Z_o. **4**

4. (a) Draw a neat diagram of JFET CG amplifier and derive expression for Av, Zi, Zo. **10**
(b) Discuss Darlington amplifier with circuit diagram, DC and AC analysis, Advantages, disadvatages and its applications. **10**

5. (a) For the following circuit, calculate following parameters. **20**
(i) Q-point for BJT and FET
(ii) Input impedance
(iii) Output impedance
(iv) Mid-frequency voltage gain (with and without load)
(v) Lower cut-off frequency.

Given : For JFET,
$I_{DSS} = 1{\cdot}6$ mA
$V_P = -2$V
$V_{GSQ} = -1{\cdot}5$V

For BJT
hie = $2{\cdot}7$ kΩ
hfe = 90



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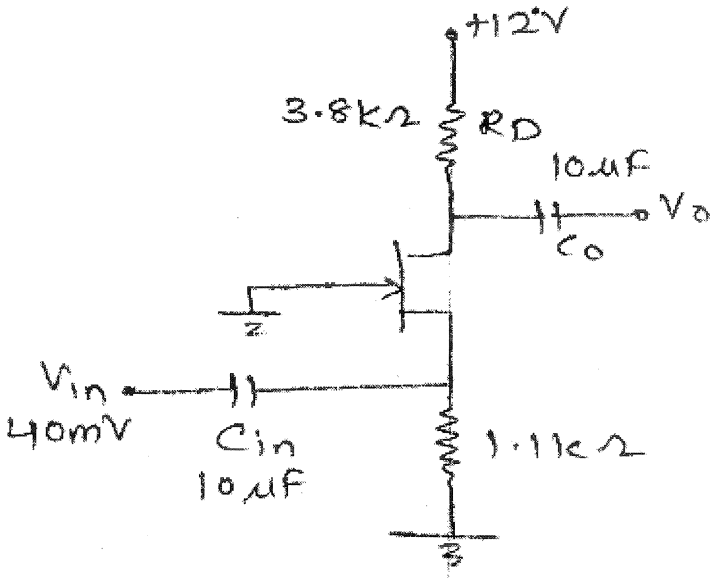
6. (a) Calculate Zin, Zo, Av and Vo **10**

Given : $I_{DSS} = 10mA$, $V_P = -4V$, $V_{GSQ} = -2{\cdot}2V$



(b) Derive expression for stability for collector to base self bias circuit. **5**

(c) Explain characteristics and working of zener diode. **5**

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DBEC DATA SHEET

Transistor type	Pdmax @ 25°C Watts	Icmax @ 25°C Amps	$V_{CE}^{(sat)}$ volts d.c.	V_{CBO} volts d.c.	V_{CEO} (5us) volts d.c.	V_{CES} (5us) volts d.c.	V_{CEX} volts d.c.	V_{EBO} volts d.c.	T_j max °C	D.C. current gain min	typ.	max.	Small Signal min.	typ.	h_{fe} max.	V_{BE} max.
2N3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8
ECN055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5
ECN149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2
ECN100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9
2N525(PNP)	0·225	0·5	0·25	85	30	—	—	—	100	35	—	65	—	45	—	—
BC147B	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9

Transistor type	hie	hoe	hre	oja
BC 147A	2·7 K Ω	18μ ℧	$1·5 \times 10^{-4}$	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	$3·2 \times 10^{-4}$	—
BC 147B	4·5 K Ω	30μ ℧	2×10^{-4}	0·4°C/mw

BFW 11—JFET MUTUAL CHARACTERISTICS

−Vgs volts	0·0	0·2	0·4	0·6	0·8	1·0	1·2	1·6	2·0	2·4	2·5	3·0
Ios max. mA	10	9·0	8·3	7·6	6·8	6·1	5·4	4·2	3·1	2·2	2·0	1·1
Ios typ. mA	7·0	6·0	5·4	4·6	4·0	3·3	2·7	1·7	0·8	0·2	0·0	0·0
Ios min. mA	4·0	3·0	2·2	1·6	1·0	0·5	0·0	0·0	0·0	0·0	0·0	0·0

N-Channel JFET

Type	V_{DS} max. Volts	V_{DG} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{fs}	$-V_p$ Volts	r_d	Derate above 25°C
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μΩ	6	50 KΩ	2 mW/°C
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5000 μΩ	2·5	50 KΩ	—

UJT type	P_d max. @25°C	I_E max. @25°C	I_p peak pulse current max.	V_{BB2} Volts max.	V_{BB1} Volts	T_j max	η min.	η max.	R_{BB} KΩ min.	R_{BB} KΩ typ.	Max.	I_p max.	μA
2N2646	300mW	50mA	2Amp.	30	35	125°C	0·56	0·75	4·7	7·0	9·1		5·0