Con. 8880–13. **GS–7128**

(3 Hours) **[Total Marks : 100**

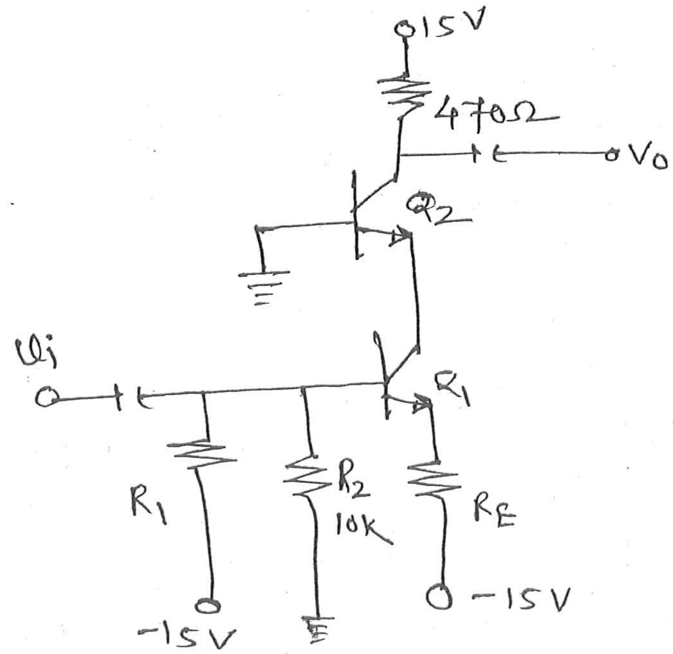
N.B. (1) Question No.**1** and 2 are **compulsory**.
(2) Attempt **three** questions from remaining **five** questions.
(3) Assume suitable **data** if **necessary**.

1. (a) Design two stage cascaded amplifier to meet following specifications. **20**
$AV \geq 600$, $Ri \geq 1\ M\Omega$, $S_{ICO} \leq 10$, $f_L = 20Hz$ and $V_o = 3V$
What would be the voltage gain of the designed circuit if both bypass capacitors are removed ? To design, use suitable transistor from data sheet.

2. (a) Design a class B push-pull power amplifier with appropriate biasing to minimize cross over distortion and using transformer coupling for 8 W output. Using 12 V d.c. supply. Assume $R_L = 5\Omega$. **15**
For the designed circuit, find efficiency at full load.
(b) A BJJ has gm = 38 m℧ , rb'e = 5·9 kΩ, hie = 6 k, rbb' - 100Ω, Cb'c = 12 pF, cb'e = 63 pf and hfe = 224 at 1 kHz. Calculate α and β cut-off frequencies and f_T. **5**

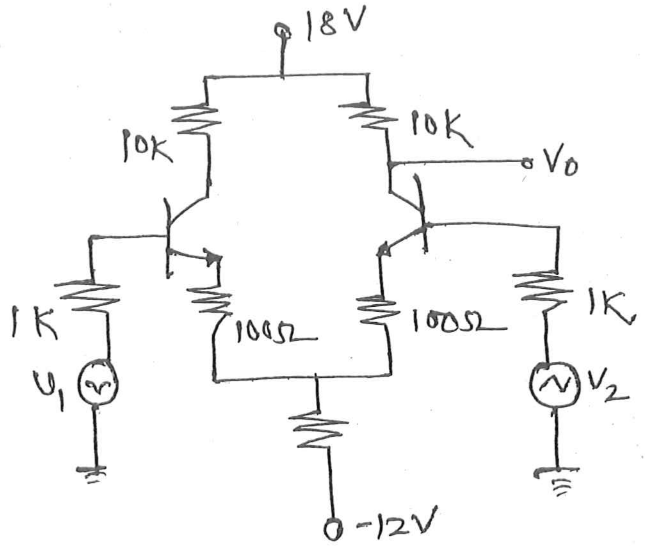
3. (a) Explain Miller's Theorem. **5**
(b) For a cascaded amplifier, show that overall lower 3dB frequency $F_{LT} = \dfrac{f_L}{\sqrt{2^{1/n}-1}}$ and higher 3dB frequency $f_{HT} = f_H\sqrt{2^{1/n}-1}$ with 'n' stages. **10**
(c) Determine maximum safe power dissipation in a transistor if the rated power is 25W, $T_{jmax} = 175°c$. The transistor is mounted on a heat sink with $\theta_{cs} = 1°$ c/w and $\theta_{5A} = 5°$ c/w. **5**

4. (a) For the cascode amplifier circuit shown in **figure**, determine the values of resistors R_E and R_1, such that the operating point is $I_{CQ} = 10$ mA and $V_{CEQ} = 10V$. **10**
Given that the values of $R_2 = 10$ k, β = 100 and V_{BE} of each transistor is 0.7V.



(b) Draw the circuit of Darlington configuration and derive the expression for current gain and Input Resistance. **10**
Also explain Principle of Bootstrapping with the help of appropriate circuit.

5 (a) **8**

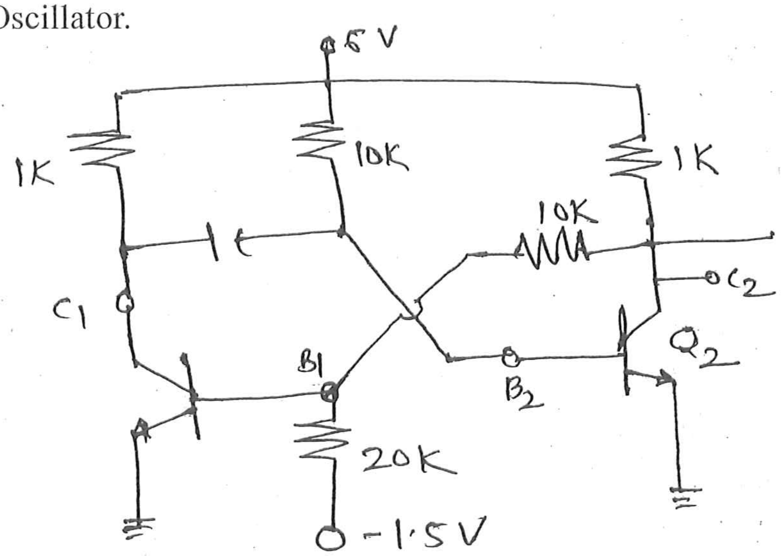


$V_{BE} = 0.6V$
$\beta ac = \beta dc = 100$
Find :–
(i) 'Q' pt
(ii) Ad
(iii) Ac
(iv) CMRR

5 (b) Derive the expression for Rif and Rof using equivalent circuit for :– **12**
(i) Voltage series negative feedback
(ii) Current shunt negative feedback.

6. (a) Explain Barkhausen's criteria. Also derive the expression for frequency of oscillation of wein Bridge Oscillator. **10**
(b) Write short notes on :– **10**
(i) Colpitt's Oscillator
(ii) Clapp Oscillator.

7. (a) **10**



For the above circuit, compute voltage levels and sketch the waveform of voltages at B_1, C_1, B_2 and C_2 for permanant state and quasi Stable state.
Use silicon transistors with $r_{bb'} = 100\ \Omega$ and $h_{FE} = 30$.
(b) Explain the various negative feedback topologies. **10**

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} (Sus) volts d.c.	V_{CER} (Sus) volts d.c.	V_{CEX} volts d.c.	V_{BEO} volts d.c.	T_j max °C	D.C. current gain min	D.C. current gain typ.	D.C. current gain max.	Small Signal h_{fe} min.	Small Signal h_{fe} typ.	Small Signal h_{fe} max.	V_{BE} max.	θ_{jc} °C/W	Derate above 25°C W/°C
2N 3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	0·7
ECN 055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	0·4
ECN 149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	0·3
ECN 100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	0·05
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N 525(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	θja
BC 147A	2·7 K Ω	18μ ℧	1·5 × 10⁻⁴	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	3·2 × 10⁻⁴	—
BC 147B	4·5 K Ω	30μ ℧	2 × 10⁻⁴	0·4°C/mw
ECN 100	500 Ω	—	—	—
ECN 149	250 Ω	—	—	—
ECN 055	100 Ω	—	—	—
2N 3055	25 Ω	—	—	—

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	3·5	4·0
IDS 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	0·5	0·0
IDS 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	0·0	0·0
IDS 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	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_{mo} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ℧	6	50 KΩ	2 mW/°C	0·59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ℧	2·5	50 KΩ	——	0·59° C/mW