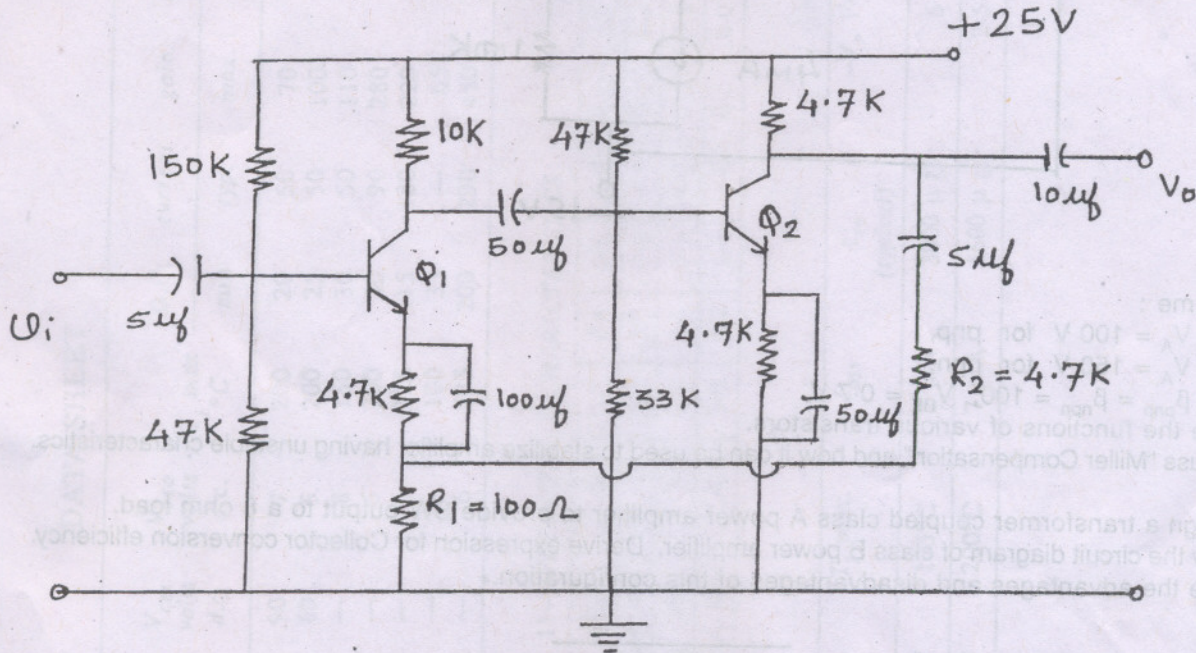


- N.B.** (1) Question No. 1 is compulsory.  
 (2) Attempt any four questions from Question Nos. 2 to 7.  
 (3) Assume suitable data wherever necessary.  
 (4) Figures to the right indicates full marks.

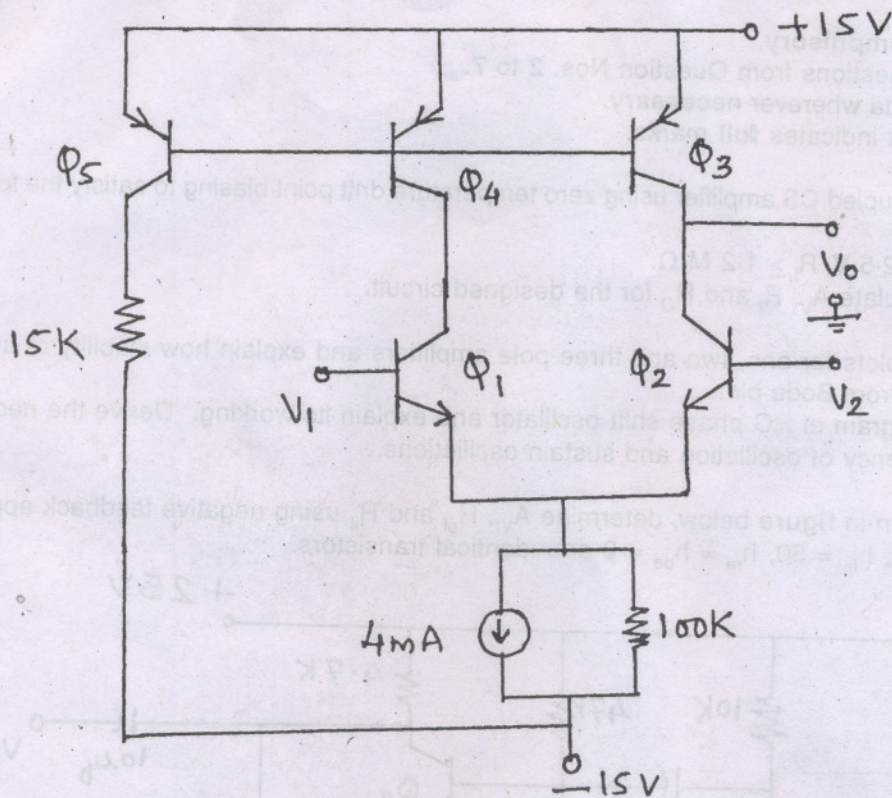
- Design a two stage RC coupled CS amplifier using zero temperature drift point biasing to satisfy the following specifications : 20  
 $|A_V| \geq 100$ ,  $V_O = 2.5$  V,  $R_i \geq 1.2$  M  $\Omega$ .  
 Use JFET BFW11. Calculate  $A_V$ ,  $R_i$  and  $R_O$  for the designed circuit.
- (a) Draw typical Bode plots for one, two and three pole amplifiers and explain how stability of amplifier can be determined from Bode plot. 10  
 (b) Draw the circuit diagram of RC phase shift oscillator and explain its working. Derive the necessary equations for frequency of oscillation and sustain oscillations. 10
- (a) For the circuit shown in figure below, determine  $A_{Vf}$ ,  $R_{of}$  and  $R_{if}$  using negative feedback approach. 10  
 Assume  $h_{ie} = 1.1$  K,  $h_{fe} = 50$ ,  $h_{re} = h_{oe} = 0$  and identical transistors.



- Give advantages and disadvantages of negative feedback on performance of amplifier. 5
  - Which type of feedback will you use to obtain amplifier with stable transconductance ? Draw one circuit diagram of such an amplifier. 5
- Write short notes on any three :— 20
    - Nyquist stability criteria
    - Differential amplifier with active load
    - Darlington amplifier
    - Crystal oscillator.
  - (a) Draw the circuit diagrams of following with values of components using OP-AMP :— 10
    - Inverting amplifier with gain of 10
    - Non-inverting amplifier with gain of 11
    - Buffer amplifier.
  - (b) Draw the functional block diagram of an OP-AMP and explain each block. State important parameters of OP-AMP. State values of these parameters for ideal OP-AMP. 10

6. (a) For the differential amplifier shown in **figure** below, determine  $A_d$ ,  $A_c$  and CMRR.

10



Assume :

$$V_A = 100 \text{ V for pnp,}$$

$$V_A = 150 \text{ V for npn,}$$

$$\beta_{\text{pnp}} = \beta_{\text{npn}} = 100, V_{BE} = 0.7 \text{ V.}$$

State the functions of various transistors.

- (b) Discuss "Miller Compensation" and how it can be used to stabilize amplifier having unstable characteristics. 10
7. (a) Design a transformer coupled class A power amplifier to provide SW output to a 8 ohm load. 10
- (b) Draw the circuit diagram of class B power amplifier. Derive expression for Collector conversion efficiency. 10
- State the advantages and disadvantages of this configuration.

## DATA SHEET

Transistor type	$P_{dmax}$ @ 25°C Watts	$I_{cmax}$ @ 25°C Amps	$V_{CE}^{(sat)}$ volts d.c.	$V_{CBO}$ volts d.c.	$V_{CEO}$ ( $S_{US}$ ) volts d.c.	$V_{CER}$ ( $S_{US}$ ) volts d.c.	$V_{CEX}$ volts d.c.	$V_{BEO}$ volts d.c.	$T_j$ max °C	D.C. current gain			Small Signal		$h_{fe}$ max.	$V_{BE}$ max.	$\theta_{jc}$ °C/W	Derate above 25°C. W/°C
										min	typ.	max.	min.	typ.				
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	$h_{ie}$	$h_{oe}$	$h_{re}$	$\theta_{ja}$
BC 147A	2.7 K $\Omega$	18 $\mu \Omega$	$1.5 \times 10^{-4}$	0.4°C/mw
2N 525 (PNP)	1.4 K $\Omega$	25 $\mu \Omega$	$3.2 \times 10^{-4}$	—
BC 147B	4.5 K $\Omega$	30 $\mu \Omega$	$2 \times 10^{-4}$	0.4°C/mw
ECN 100	50 $\Omega$	—	—	—
ECN 149	15 $\Omega$	—	—	—
ECN 055	12 $\Omega$	—	—	—
2N 3055	6 $\Omega$	—	—	—

### BFW 11—JFET MUTUAL CHARACTERISTICS

-V <sub>GS</sub> 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
I <sub>DS</sub> 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
I <sub>DS</sub> 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
I <sub>DS</sub> 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.	$I_{DSS}$	$g_{ms}$ (typical)	$-V_p$ Volts	$r_d$	Derate above 25°C	$\theta_{ja}$
2N3822	50	50	50	300 mW	175°C	2 mA	3000 $\mu \Omega$	6	50 K $\Omega$	2 mW/°C	0.59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 $\mu \Omega$	2.5	50 K $\Omega$	—	0.59°C/mW