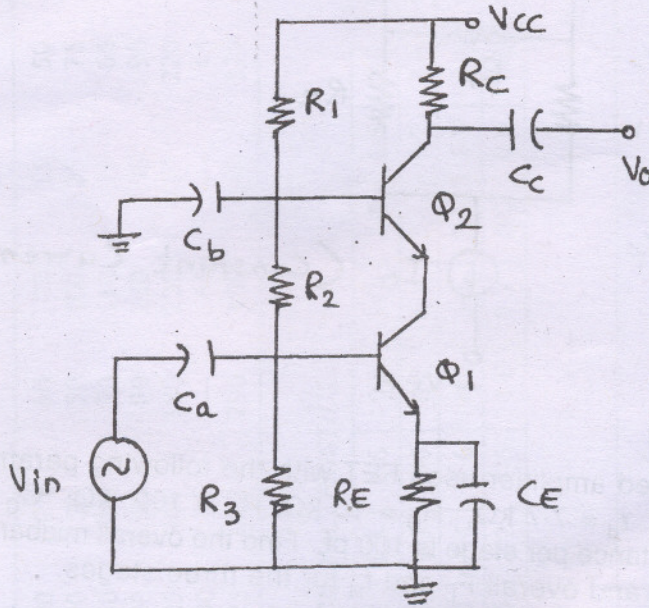


- N.B.** (1) Question No. 1 is **compulsory**.  
 (2) Attempt any **four** questions from Question Nos. 2 to 7.  
 (3) Assume **suitable** data wherever **necessary**.  
 (4) **Figures** to the **right** indicates **full marks**.

1. Attempt any **four** of the following :—

- (a) Calculate the values of  $R_C$ ,  $R_1$  and  $R_2$  of the following circuit.  $V_{CC} = 9V$ ,  $R_3 = 18 K\Omega$ ,  $V_{C1} = 3V$ ,  $V_{C2} = 6V$ ,  $I_C = 1mA$ ,  $R_E = 200\Omega$ ,  $V_{BE1} = V_{BE2} = 0.7V$ .

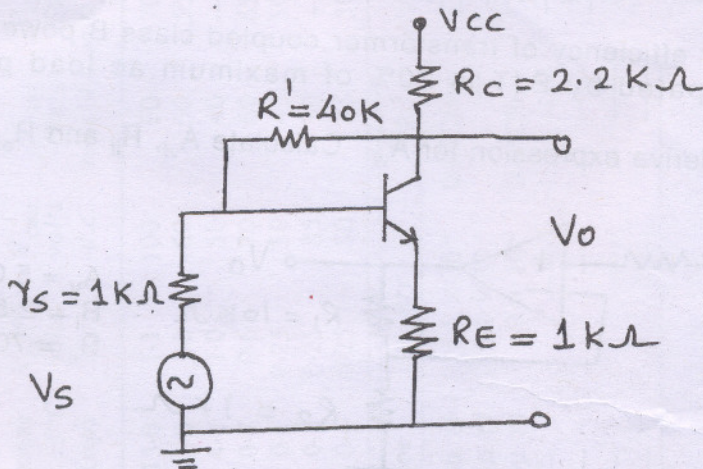
5



- (b) Draw and explain the current mirror circuit as constant current source. 5  
 (c) Explain the concept of virtual ground in OP-AMP. 5  
 (d) Design a phase-shift oscillator using FET (BFW11) and feedback circuit value of  $R = 10 K\Omega$  for 1 KHz frequency. 5  
 (e) Explain an method overcome cross over distortion in clas B power amplifier. 5

2. (a) For the circuit shown in **figure**, determine  $A_{vf}$ ,  $A_{if}$ ,  $R_{if}$  and  $R_{of}$ .

12



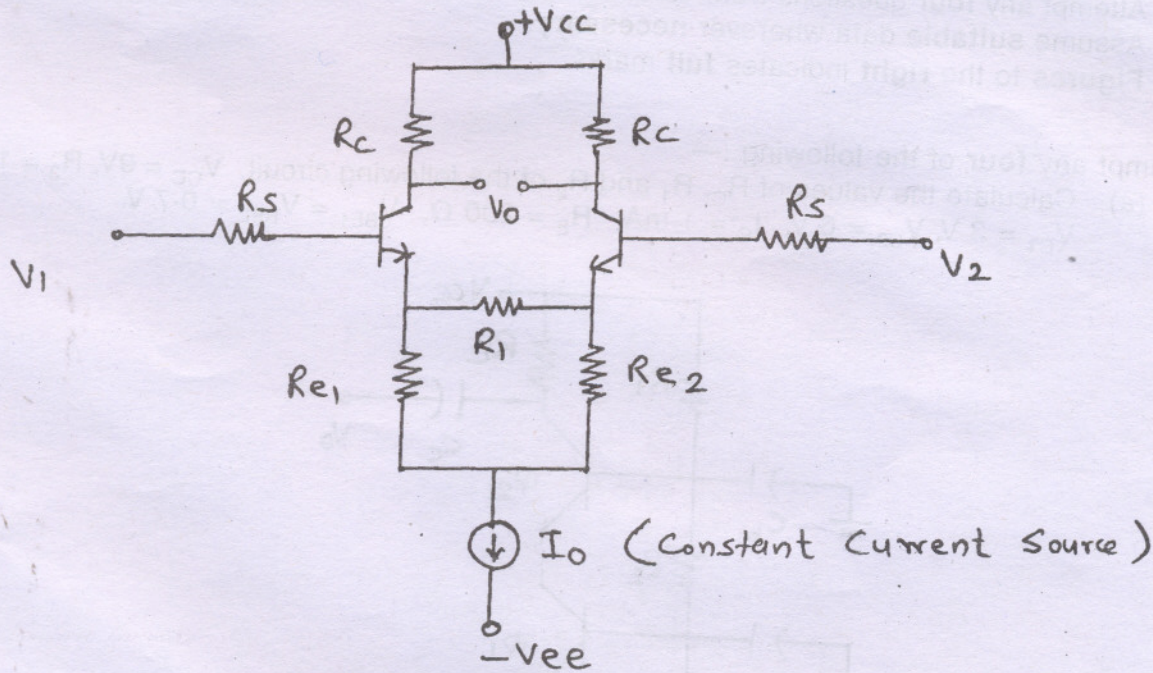
$$h_{ie} = 1.5k\Omega,$$

$$h_{fe} = 75.$$

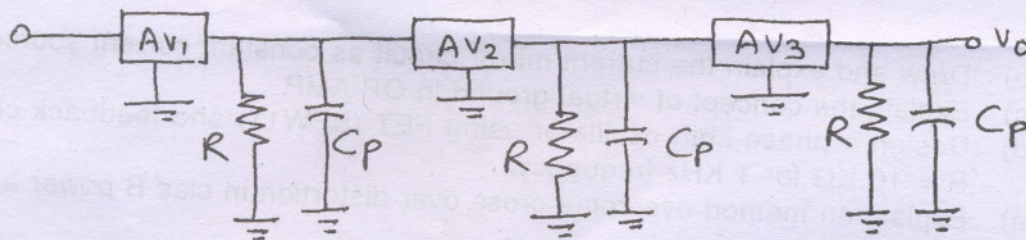
(b) Compare various types of Negative feedbacks with block diagram.

8

3. (a) Draw the circuit diagram of Wien Bridge oscillator and explain its working. Derive the equation for frequency of oscillation. 10  
 (b) For the circuit shown, derive expression for Differential mode gain ( $A_d$ ). 10

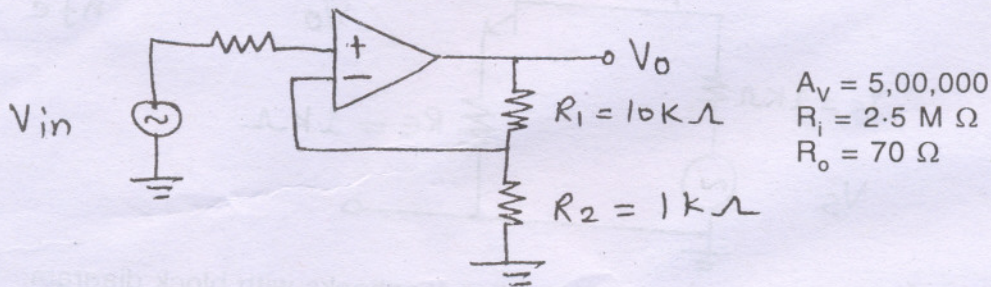


4. (a) A three stage RC coupled amplifier uses FET with the following parameters :— 12  
 $g_m = 26 \text{ mA/V}$ ,  $r_d = 7.7 \text{ k}\Omega$ ,  $R_D = 10 \text{ k}\Omega$ ,  $R_G = 100 \text{ k}\Omega$ ,  $C_C = 0.005 \mu\text{f}$ .  
 The total shunting capacitance per stage is 100 pf. Find the overall midband gain in decibels,  $F_L$  and  $f_H$  of each stage and overall  $F_L$  and  $f_H$  for the three stages.



- (b) Explain the high frequency analysis of BJT amplifier. Derive necessary expressions. 8

5. (a) Derive the expression for efficiency of transformer coupled class B power amplifier. Prove that power dissipated by BJT is 20% of maximum ac load power-i.e.,  $P_{Q(\text{max})} = 0.2 P_{Oac(\text{max})}$ . 10  
 (b) For the following circuit, derive expression for  $A_{vf}$ . Calculate  $A_{vf}$ ,  $R_{if}$  and  $R_{of}$ . 10



6. Design two stage audio frequency RC coupled multistage amplifier for mid frequency voltage gain  $A_V \geq 3000$ ,  $V_{CC} = 15 \text{ V}$ ,  $R_i > 4 \text{ k}\Omega$ . Calculate  $A_V$ ,  $R_i$  and  $R_o$  for the designed circuit. 20

7. Write short notes on any three :— 20  
 (a) Millers Integrator  
 (b) Differential Amplifier with Active Load  
 (c) Darlington Amplifier

### DATA SHEET

Transistor type	$P_{dmax}$	$I_{cmax}$	$V_{CE}^{(sat)}$	$V_{CBO}$	$V_{CEO}$	$V_{CER}$	$V_{CEX}$	$V_{BE0}$	$T_j$ max	D.C. current	gain	Small Signal	$h_{fe}$	$V_{BE}$ max.	$\theta_{jc}$	Derate		
	@ 25°C	@ 25°C	volts	volts	(Sus)	(Sus)	volts	volts									min	typ.
	Watts	Amps	d.c.	d.c.	volts d.c.	volts d.c.	d.c.	d.c.	°C									
V 3055	115.5	15.0	1.1	100	60	70	90	7	200	20	50	70	15	50	120	1.8	1.5	0.0
CN 055	50.0	5.0	1.0	60	50	55	60	5	200	25	50	100	25	75	125	1.5	3.5	0.0
CN 149	30.0	4.0	1.0	50	40	—	—	8	150	30	50	110	33	60	115	1.2	4.0	0.0
CN 100	5.0	0.7	0.6	70	60	65	—	6	200	50	90	280	50	90	280	0.9	35	0.0
C147A	0.25	0.1	0.25	50	45	50	—	6	125	115	180	220	125	220	260	0.9	—	—
V 525(PNP)	0.225	0.5	0.25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
C147B	0.25	0.1	0.25	50	45	50	—	6	125	200	290	450	240	330	500	0.9	—	—

Transistor type	$h_{ie}$	$h_{oe}$	$h_{re}$	$\theta_{ja}$
C 147A	2.7 K $\Omega$	18 $\mu \Omega$	$1.5 \times 10^{-4}$	0.4°C/mw
N 525 (PNP)	1.4 K $\Omega$	25 $\mu \Omega$	$3.2 \times 10^{-4}$	—
C 147B	4.5 K $\Omega$	30 $\mu \Omega$	$2 \times 10^{-4}$	0.4°C/mw
CN 100	500 $\Omega$	—	—	—
CN 149	250 $\Omega$	—	—	—
CN 055	100 $\Omega$	—	—	—
N 3055	25 $\Omega$	—	—	—

#### 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

#### V-Channel JFET

Type	$V_{DS}$ max.	$V_{DG}$ max.	$V_{GS}$ max.	$P_d$ max.	$T_j$ max.	$I_{DSS}$	$g_{mo}$	$-V_p$ Volts	$r_d$	Derate	$\theta_{ja}$
	Volts	Volts	Volts	@25°C	°C		(typical)			above 25°C	°C/mw
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