S.E Sem IV Electronic circuit Analysis & Design II 23-5-06

57 : 1sthalf-D98

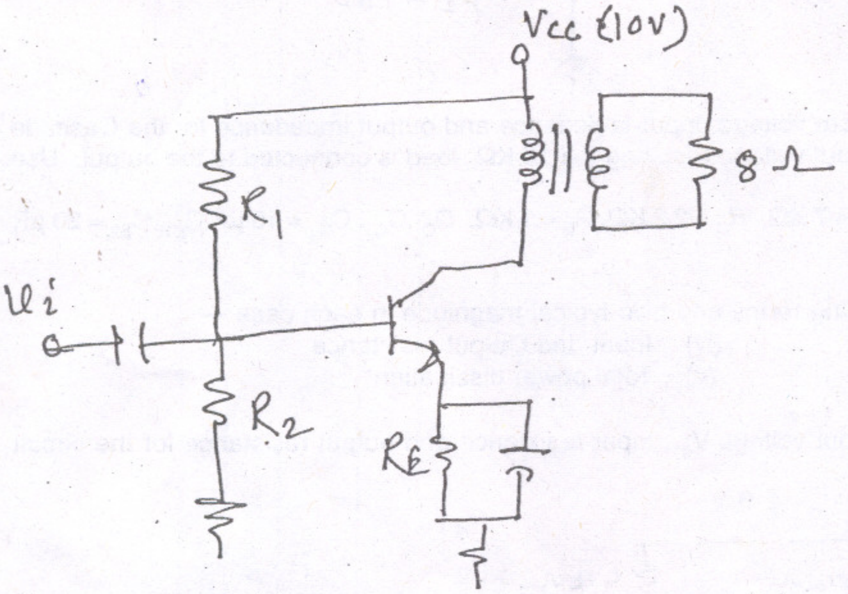
Con. 2490-06. **(REVISED COURSE)** **TV-11133**

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

N.B. (1) Question No. **1** is **compulsory.**
(2) Answer any **four** questions from **remaining.**
(3) Assume **suitable** data whenever **necessary.**

1. (a) Derive the expression of transformer coupled class A amplifier ? What is the maximum efficiency at class A and class B transformer coupled amplifier ? 6

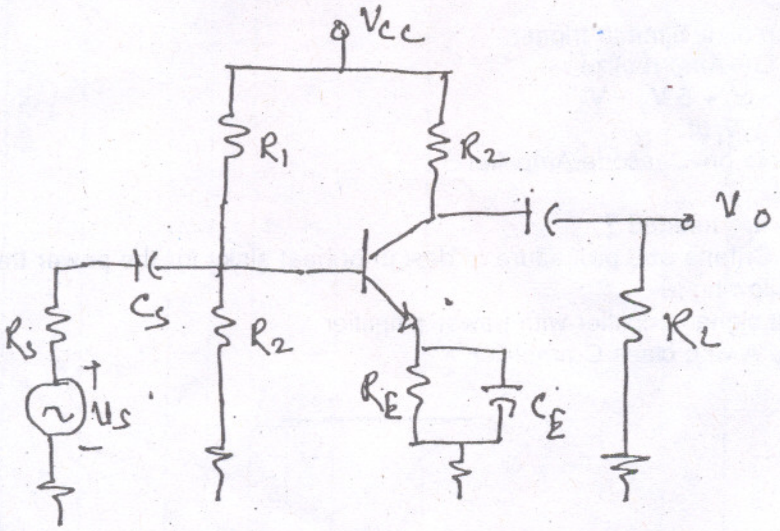
(b) Calculate the ac power delivered to the 8 Ω speaker, dc input power, power dissipated by the transistor and efficiency of the circuit shown in **figure.** 8



$V_{CEQ} = 10$ V
$I_{CEQ} = 140$ mA
V_{CE} min $= 1{\cdot}7$ V
V_{CE} max $= 18{\cdot}3$ V
I_C min $= 25$ mA
I_C max $= 255$ mA

(c) Determine the input power, output power and circuit efficiency for a class B amplifier providing a 20 V peak signal to a 16 Ω load and power supply at $V_{CC} = 30$ V. 6

2. (a) Determine the lower cutoff frequency for the network of **figure :—** 15



$C_S = 10\ \mu f$, $C_E = 20\ \mu f$, $C_C = 1\ \mu f$
$R_S = 1\ K\Omega$, $R_1 = 40\ K\Omega$, $R_2 = 10\ K\Omega$, $R_E = 2\ K\Omega$
$R_C = 4\ K\Omega$, $R_L = 2{\cdot}2\ K\Omega$
$\beta = 100$, $\xi_O = \infty\Omega$, $V_{CC} = 20$ V

Sketch the frequency response using Bode plot.

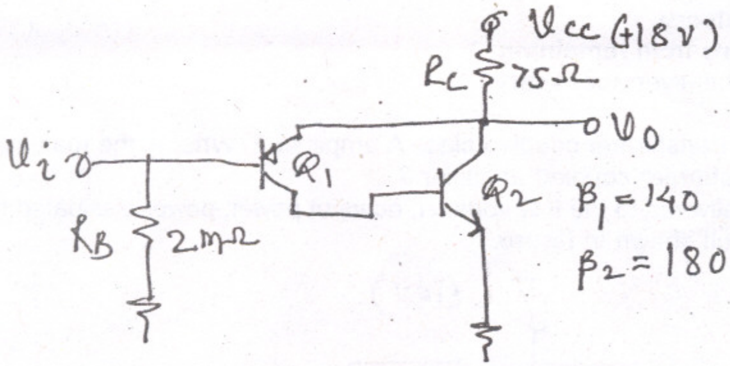
(b) State and explain Miller Theorem. How it is useful to determine the frequency response of amplifier ? 5

3. (a) Draw the circuit diagram of Wien Bridge Oscillator and explain its working. Derive the equation for frequency of oscillation ? 10

(b) Design a phase-shift oscillator using FET (BFW 11) and feedback circuit value of R = 10 KΩ for 1 KHz frequency. 6

(c) What are the advantages of negative feedback on performance of amplifier ? 4

4. (a) Calculate the D.C. bias currents and voltages for the **figure** to provide V_0 at one half the supply voltage. 5

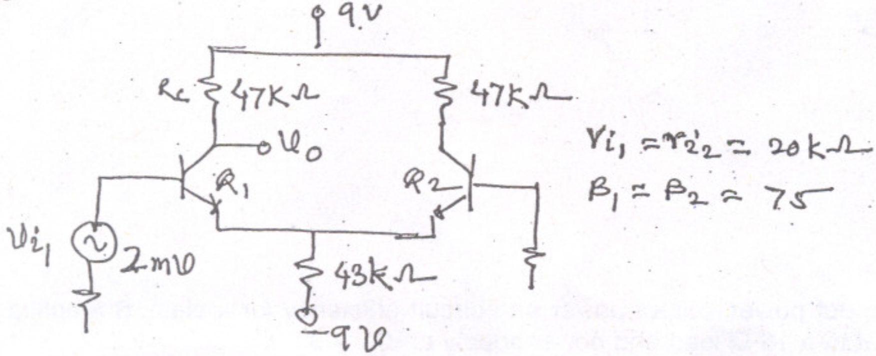


(b) Calculate the voltage gain, output voltage, input impedance and output impedance for the Cascade BJT amplifier, calculate the output voltage resulting it a 10 KΩ load is connected to the output. Use following parameters :— 15

($V_i = 25\ \mu V$, $R_1 = 15\ K\Omega$, $R_2\ 4{\cdot}7\ K\Omega$, $R_C = 2{\cdot}2\ K\Omega$, $R_E = 1\ K\Omega$, $C_{C_1}, C_{C_2}, C_{C_3} = 10\ \mu F$, $C_{E1}, C_{E2} = 20\ \mu F$, $\beta = 200$, $V_{CC} = +20\ V$).

5. (a) For OP Amp 741 explain following terms and give typical magniude in each case — 10
   - (i) Input offset voltage
   - (ii) Slew rate
   - (iii) CMRR
   - (iv) Input and Output resistance
   - (v) Total power dissipation.

(b) Calculate the single ended output voltage V_{01}, input resistance and output resistance for the circuit shown in **figure**. 5



(c) Explain the need of compensating networking in OP-Amp. 5

6. (a) Explain OP-Amp as a Schmitt trigger. 6

(b) Using practical OP-Amp realize :— 10
   - (i) $V_0 = > V_i + 5\ V_2 - V_3$
   - (ii) $V_0 = \int V_i\, dt$.

(c) Write a short note on 'Cascode Amplifier'. 4

7. (a) Why heat sinks are needed ? 10
Explain Design Criteria and procedure of design of heat sinks for the power transistors.

(b) Compare the following :— 10
   - (i) Small signal amplifier with power amplifier
   - (ii) Class A with class C amplifier.

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*			*Small Signal* h_{fe}			V_{BE} *max.*	O_{jc} *°C/W*	*Derate above 25°C W/°C*
										min	*typ.*	*max.*	*min.*	*typ.*	*max.*			
2*N* 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
*BC*147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2*N* 525(*PNP*)	0·225	0·5	0·25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
*BC*147*B*	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 147*A*	2·7 *K* Ω	18μ ℧	1·5 × 10^{-4}	0·4°C/mw
2*N* 525 (*PNP*)	1·4 *K* Ω	25μ ℧	3·2 × 10^{-4}	—
BC 147*B*	4·5 *K* Ω	30μ ℧	2 × 10^{-4}	0·4°C/mw
ECN 100	50 Ω	—	—	—
ECN 149	15 Ω	—	—	—
ECN 055	12 Ω	—	—	—
2*N* 3055	6 Ω	—	—	—

BFW 11—*JFET MUTUAL CHARACTERISTICS*

–V_{GS} 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_{DS} 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_{DS} 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_{DS} 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}
2*N*3822	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