S.E. Sem 4

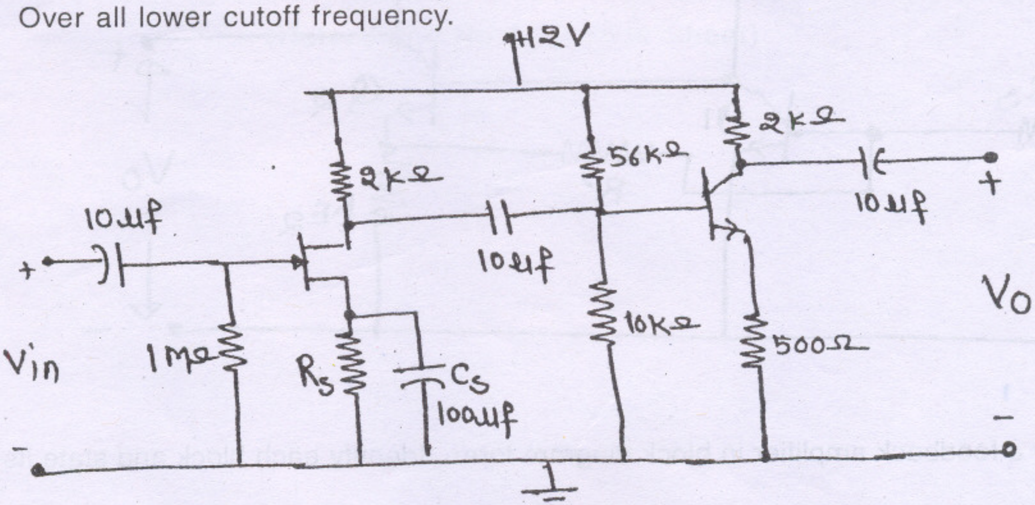
Etrx. Electronic circuit Analysis & Design -II 10/12/08.

Con. 5034-08. **RC-6095**

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

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** with **proper** justification.
(4) **Figures** to the **right** indicate **full** marks.

1. For the circuit shown in **figure** determine the following parameters 20
   - (a) Value of R_s
   - (b) DC bias for both stages (Q — points)
     Assume $V_{GSQ} = -1$ volt $I_{DSS} = 8$ mA $V_p = -4$V for JFET and $h_{ie} = 1$ kΩ, $h_{fe} = \beta = 100$, $V_{BE} = 0{\cdot}6$ Volt for BJT.
   - (c) Mid frequency voltage gain (A_v) for the complete amplifier with and without C_s.
   - (d) Over all lower cutoff frequency.



2. Design a two stage R-C coupled BJT amplifier using BJT BC 147A for the following requirement. 20

   $A_v \geq 1500$
   $S \leq 8$
   f_L better than 10 Hz
   $V_0 = 3\ V_{peak}$.

3. (a) Draw the circuit diagram of a transformer coupled push-pull class B amplifier and explain its working with load line and waveforms. What is the maximum efficiency possible (Derive) ? 10

   (b) For a power MOSFET the thermal resistance parameters are as follows : 10

   $\theta_{dev\text{-}case} = 1{\cdot}75$°C/W
   $\theta_{case\text{-}sink} = 1$°C/W
   $\theta_{sink\text{-}amb} = 5$°C/W
   $\theta_{case\text{-}amb} = 50$°C/W

   The ambient temperature is 30 °C. The maximum junction or device temperature is 120°C. Draw the electrical equivalent circuit for heat flow from device to ambience. Determine the maximum power dissipation in the transistor when
   - (i) No heat sink is used.
   - (ii) A heat sink is used.

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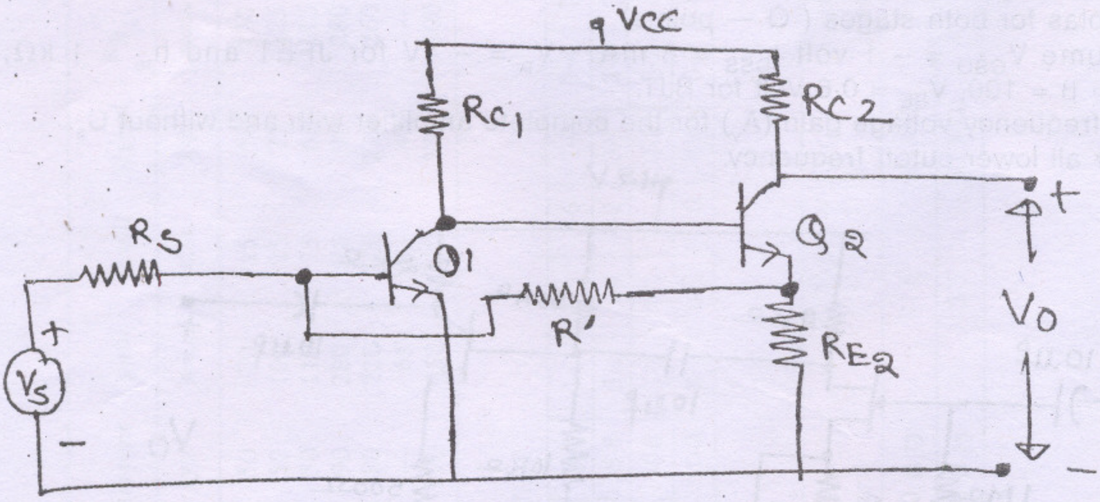
4. (a) The circuit in the **figure** has the following parameters. 10

$R_{c_1} = 3\ k\ \Omega$ $R_{c_2} = 500\ \Omega$ $R_{E_2} = 50\ \Omega$

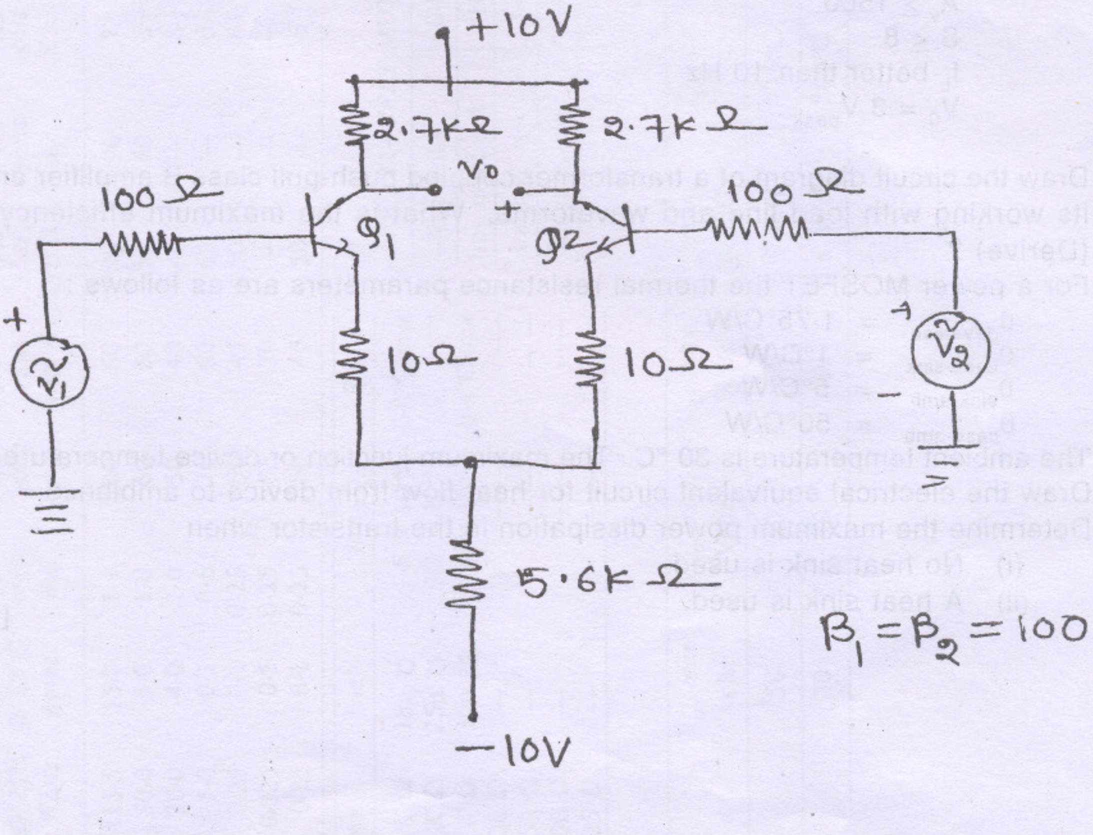
$R^1 = R_s = 1{\cdot}2\ k\Omega$ $h_{fe} = 50$ $h_{ie} = 1{\cdot}1\ k\Omega$

(i) Identify the type of feedback
(ii) Find Avf
(iii) Find the resistance seen by the voltage source
(iv) Find the output resistance.



(b) Draw a feedback amplifier in block diagram form. Identify each block and state its function. 10

5. (a) Analyse the following circuit diagram to obtain the expressions for the differential voltage gain, common mode gain and differential input resistance. Hence find their values. 10



(b) What is a power MOSFET ? Explain its construction equivalent circuit and characteristics. 10

6. (a) Give the circuit diagram of collpitts oscillator. Derive expression for frequency of output signal. Determine condition to be satisfied for sustained oscillations. **10**

   (b) Draw the circuit diagrams of following with values of components using op-amp. **10**
      - (i) Inverting amplifier with gain of 10
      - (ii) Non inverting amplifier with gain of 11
      - (iii) RC phase shift oscillator with frequency of oscillation as 1 KHz.

7. Write short notes on the following (any **two**) :— **20**
   - (a) Darlington amplifier
   - (b) Cascode amplifier
   - (c) Nyquist stability criteria.

(Refer Page No.4 for Data Sheet)

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DATA SHEET

ns:stor 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.*	0_{fe} *°C/W*	*Derate above 25°C W/°C*
										min	*typ.*	*max.*	*min.*	*typ.*	*max.*			
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
V 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
V 149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	0·3
V 100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	0·05
147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
525(*PNP*)	0·225	0·5	0·25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
147*B*	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9	—	—

nsistor type	*hie*	*hoe*	*hre*	*θja*
147*A*	2·7 *K* Ω	18µ ℧	1·5 × 10^{-4}	0·4°C/mw
525 (*PNP*)	1·4 *K* Ω	25µ ℧	3·2 × 10^{-4}	—
147*B*	4·5 *K* Ω	30µ ℧	2 × 10^{-4}	0·4°C/mw
N 100	500 Ω	—	—	—
N 149	250 Ω	—	—	—
N 055	100 Ω	—	—	—
3055	25 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

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}
3822	50	50	50	300 mW	175°C	2 mA	3000 µ ℧	6	50 KΩ	2 mW/°C	0·59°C/mW
W 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 µ ℧	2·5	50 KΩ	——	0·59° C/mW