

(REVISED COURSE)

(3 Hours)

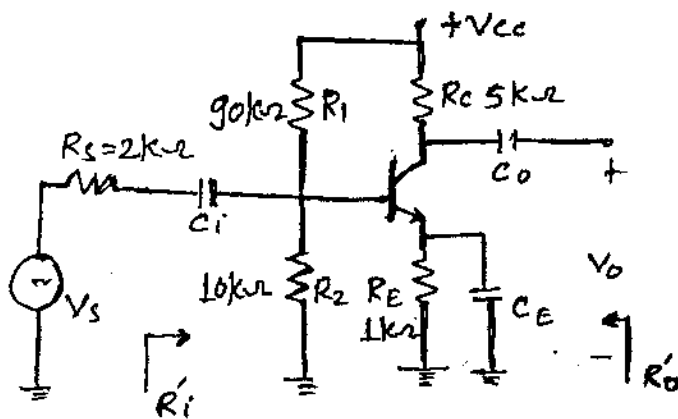
[Total Marks : 100

- N.B. : (1) Question No. 1 is **compulsory**.
 (2) Out of remaining questions, attempt any **three** questions.
 (3) **In all five** questions to be attempted.
 (4) **Figures** to the right indicate full marks.

1. (a) Design single stage RC coupled CE amplifier employing BC 147A to give a voltage gain of $A_V = 100$, $S_{iCO} \leq 10$ and output voltage of $V_O = 3V$. 15
 (b) For the above designed amplifier determine; voltage gain, input impedance, output impedance, current supplied by source V_{CC} and voltage gain if capacitor C_e is removed. 5

2. (a) Design single stage CS amplifier employing JFET type BFW11 with biasing circuit to provide stability of operating Q point against device parameter variation so that $2.25 \text{ mA} \leq I_D \leq 4.2 \text{ mA}$ and $A_V = 12$. Use transfer characteristics of JFET from data sheet. Assume $r_d = 50 \text{ k}$ for JFET. 15
 (b) From the design amplifier, determine what will be the maximum output voltage that can be obtained without distortion and corresponding input voltage that can be applied in the worst condition. 5

3. (a) Sketch the input output characteristic curves for a transistor in CB connection and show how would obtain the four parameters h_{ib} , h_{fb} , h_{rb} , and h_{ob} ? Why are h-parameter conversion formulas necessary? 10
 (b) The transistor amplifier shown in **figure** has the following parameters : 10
 $h_{ie} = 2\text{k}\Omega$; $h_{fe} = 50$; $h_{re} = 2 \times 10^{-4}$; and $h_{oe} = 20 \times 10^{-6} \text{ A/V}$.
 Derive the expression for overall voltage gain A_{VS} , input impedance R_i , and current gain A_{IS} and evaluate the same.

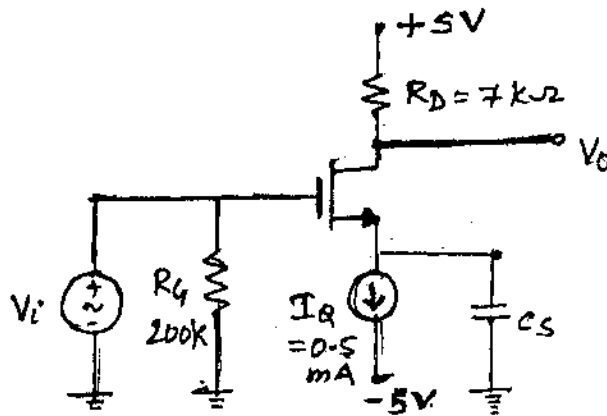


4. (a) In a germanium transistor using potential divider biasing method, the operating point is chosen such that $I_C = 2\text{mA}$, $V_{CE} = 4V$. If $R_C = 2 \text{ k}\Omega$, $V_{CC} = 10\text{V}$, and $\beta = 50$. Determine the values of R_1 , R_2 , and R_E . Assume $I_1 = 10 I_B$. I_1 is current through R_1 . 10
 (b) What is the principle of providing thermal stabilization by means of different methods of transistor biasing? Explain the bias compensation techniques using a diode and thermistor or sensor. 10

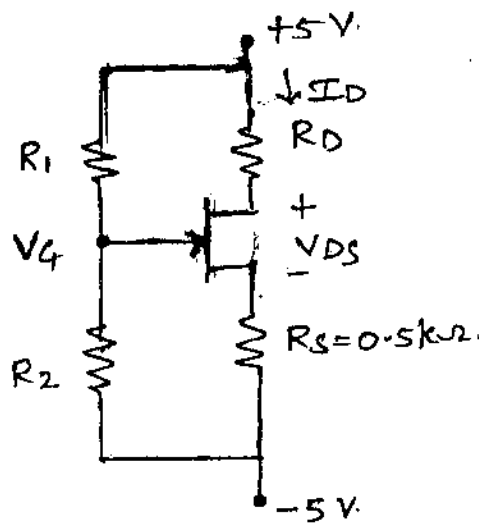
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5. (a) For the circuit shown in figure analyze and determine :

- (i) DC bias condition
 - (ii) Small-signal voltage gain
 - (iii) Input and output impedance.
- $V_{TN} = 0.8 \text{ V}$, $K_n = 1 \text{ mA/V}^2$, and $\lambda = 0.001 \text{ V}^{-1}$.

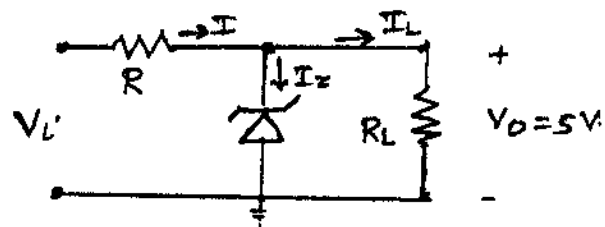


(b) The parameters of the transistor in the JFET common-source amplifier shown in figure are : $I_{DSS} = 10 \text{ mA}$, $V_p = -3.5 \text{ V}$, $R_1 + R_2 = 120 \text{ k}\Omega$ and the Q-point is at $I_{DQ} = 5 \text{ mA}$ and $V_{DS} = 5 \text{ V}$. Determine the values of R_1 , R_2 and R_D .



6. (a) Design capacitor filter with full wave rectifier to meet particular specifications. The peak output voltage of 12 V, deliver 120 mA to the load, and produce an output with a ripple of not more than 5 percent. An input line voltage of 120 V and 50Hz is available. 12

- (b) Design a Zener voltage regulator to meet the following specifications : 8
Output voltage $V_0 = 5\text{ V}$, Load current $I_L = 10\text{ mA}$, Zener wattage = 400 mW
and Input voltage $V_i = 10\text{ V} \pm 2\text{ V}$.



7. Write a short notes on following : 20
(a) UJT relaxation oscillator
(b) Power MOSFET
(c) MOSFET biasing
(d) Critical Inductance in filter.

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DBEC DATA SHEET

Transistor type	P _{dm} max @ 25°C Watts	I _{cm} max @ 25°C Amps	V _{CE} (sat) volts d.c.	V _{GRO} volts d.c.	V _{CEO} (S _{US}) volts d.c.	V _{CER} (S _{US}) volts d.c.	V _{CES} volts d.c.	V _{BE0} volts d.c.	T _j max °C	D.C. current			Signal typ.	h _{FE} max.	V _{BE} max.	θ _{JC} °C/W	Derate above 25°C W/°C	
										min	typ.	max.						
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}	β _{ia}	BFW 11—JFET MUTUAL CHARACTERISTICS															
					-V _{GS} volts	I _{DS} max. mA	I _{DS} typ. mA	I _{DS} min. mA	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.6	2.0	2.4	2.5	3.0
BC 147A	2.7 K Ω	18μ Ω	1.5 × 10 ⁻⁴	0.4°C/mW	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	0.0	
2N 525 (PNP)	1.4 K Ω	25μ Ω	3.2 × 10 ⁻⁴	—	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	0.0	
BC 147B	4.5 K Ω	30μ Ω	2 × 10 ⁻⁴	0.4°C/mW	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	0.0	
ECN 100	500 Ω	—	—	—	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	0.0	
ECN 149	250 Ω	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
ECN 055	100 Ω	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
2N 3055	25 Ω	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

N-Channel JFET		V _{DS} max.	V _{GS} max.	V _{GS} max.	P _d max.	T _j max.	I _{SS}	g _{max}	-V _P Volts	r _d	Derate	θ _{JA}
Type		Volts	Volts	Volts	@25°C			(typical)			above 25°C	
2N3822		50	50	50	300 mW	175°C	2 mA	3000 μ Ω	6	50 KΩ	2 mW/°C	0.59° C/mW
BFW 11 (typical)		30	30	30	300 mW	200°C	7 mA	5600 μ Ω	2.5	50 KΩ	—	0.59° C/mW