

S.E. (ELECTRONICS BIO-MEDICAL) (SEM III) (REV) EXAMINATION,
OCTOBER 2006

Electronic Circuit Analysis Design I
(REVISED COURSE)

Con. 4794-06.

YM-5227

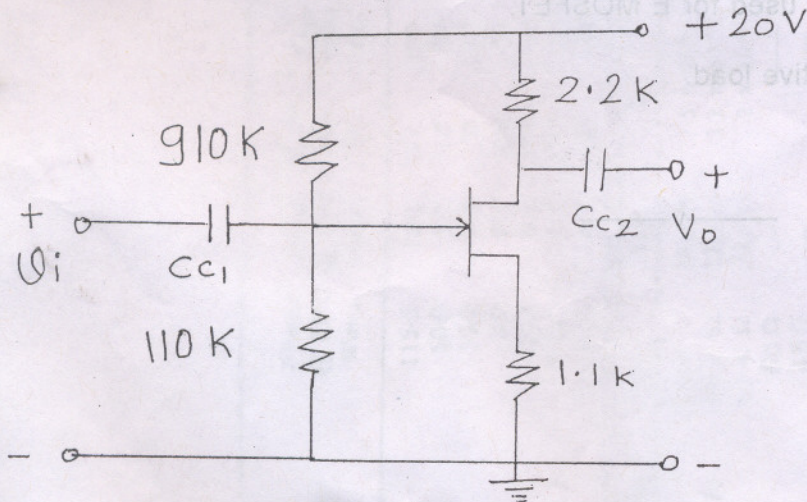
30/6/06
(3 Hours)

[Total Marks : 100

- N.B. : (1) Question no. 1 is compulsory.
(2) Attempt any four questions from remaining.
(3) Figures to the right indicate full marks.
(4) Assume suitable additional data wherever necessary.

1. (a) Give reasons for any three of the following :— 12
- (i) CE configuration of BJT is preferred over CB and CC, when used as a switch.
 - (ii) In a BJT, interchange of collector and emitter terminals degrades the performance.
 - (iii) PIV of a FWR with centre tapped transformer is $2 V_m$.
 - (iv) JFET can be used as a Voltage Variable Resistor.
 - (v) JFET is not operated with Forward V_{GS} Voltage in an amplifier.
- (b) Design a Full Wave Rectifier with L Section LC filter to provide 15 V dc at 150 mA, with a maximum ripple of 3%. Assume the input supply frequency to be 50 Hz. Is the Bleeder Resistance essential in the above circuit ? If required calculate the value of Bleeder Resistance. 8
2. (a) A CE amplifier employing NPN transistor has load resistance R_C connected between collector and V_{CC} Supply of + 16 V. For biasing a resistor R_1 is connected between collector and base, resistor $R_2 = 30 K\Omega$ is connected between Base and ground and resistor $R_E = 1 K\Omega$ is connected between emitter and ground. 10
- Draw the circuit diagram.
- Calculate the values of R_1 and R_C if $V_{BE} = 0.2 V$, $I_{EQ} = 2 mA$, $\alpha = 0.985$ and $V_{CEQ} = 6 V$.
- (b) Discuss various biasing circuits used for BJT, state their possible applications in actual circuits. Which biasing circuit will you use if BJT is to be used as constant current source. Justify. 10
3. Design a single state RC coupled CE-BJT amplifier using potential Divider Bias with unbypassed emitter resistance R_E , to satisfy following specifications :— 20
- $V_0 = 4 V$, $|A_V| = 90$. Use BJT BC147 A.
- Calculate R_i and R_o for the designed circuit. 20
4. Design a Common Source JFET amplifier using potential Divider Biasing, for following specifications :—
- $F_L = 20 Hz$, $V_o = 2 V$
 $I_D = 3.3 \pm 0.6 mA$,
 $|A_V| = 11$.
Use FET – BFW11.
- Calculate R_p , R_o and $V_{o_{max}}$ for the designed amplifier. 10

5.22 (a) For the JFET amplifier of circuit shown below, calculate A_v , R_i and R_o .



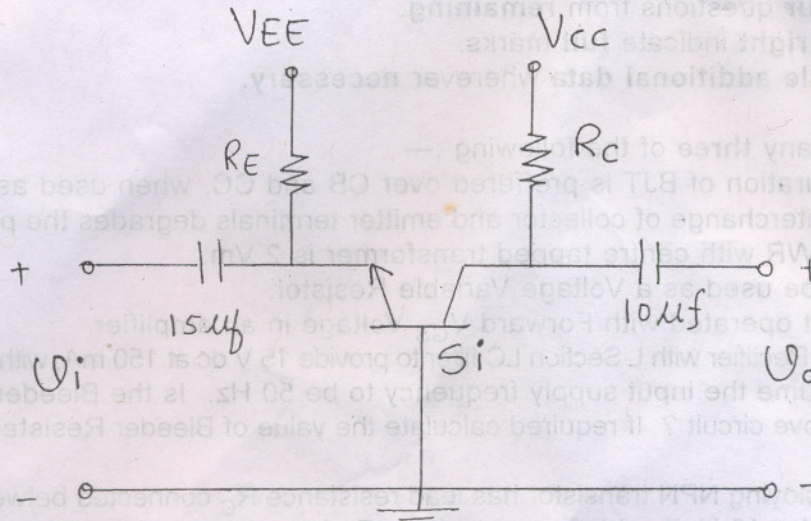
Assume,

$$I_{DSS} = 10\text{mA},$$

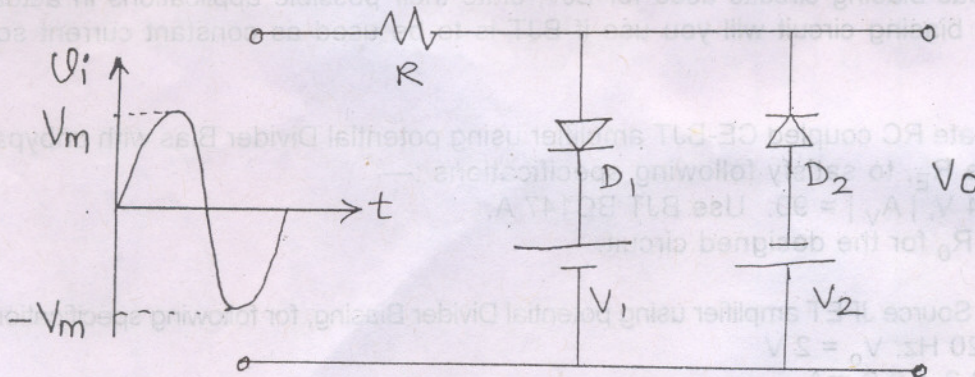
$$V_p = -3.5\text{V}.$$

- (b) Discuss two stage MOSFET amplifier, when a common source input stage is feeding a Common Drain output stage. Analyse this circuit.

6. (a) For the circuit given below, draw the small signal equivalent circuit and determine A_v , A_i , R_i and R_o . Assume $V_{EE} = -4\text{ V}$, $\beta = 150$, $R_E = 3.3\text{ K}$, $R_C = 7.1\text{ K}$, $V_{CC} = 10\text{ V}$. 10



- (b) (i) Explain with neat waveforms, working of following circuit :— 5



- (ii) Compare JFET amplifier with BJT amplifier. 5

7. Write short notes on any four of the following :— 20

- Application of MOSFET as Digital Logic Gates.
- Thermal stabilization and compensation.
- Various biasing schemes used for E MOSFET.
- Photo diode.
- CE-BJT amplifier with active load.

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} (Sus) volts d.c.	V_{CES} (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.	θ_{JA} °C/W	Derate above 25°C W/°C
										min	typ.	max.	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}	θ_{ja}
BC 147A	2.7 K Ω	18 μ U	1.5×10^{-4}	0.4°C/mw
2N 525 (PNP)	1.4 K Ω	25 μ U	3.2×10^{-4}	—
BC 147B	4.5 K Ω	30 μ U	2×10^{-4}	0.4°C/mw
ECN 100	50 Ω	—	—	—
ECN 149	15 Ω	—	—	—
ECN 055	12 Ω	—	—	—
2N 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_{OSS}	g_{ms} (typical)	-V _p Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ U	6	50 K Ω	2 mW/°C	0.59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ U	2.5	50 K Ω	—	0.59°C/mW