S.E. sem 3 (Rev.) Basics of Electronics Circuits 04/12/08
Extx.

Con. 5446-08. **RC-8723**

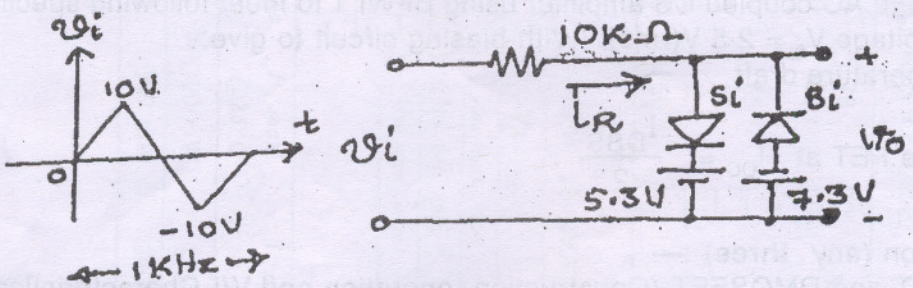
(REVISED COURSE)

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

N.B.: (1) Question No. **1** is **compulsory.**
(2) Attempt any **four** out of remaining **six** questions.
(3) Assume **suitable** data wherever **required** and justify the **same.**

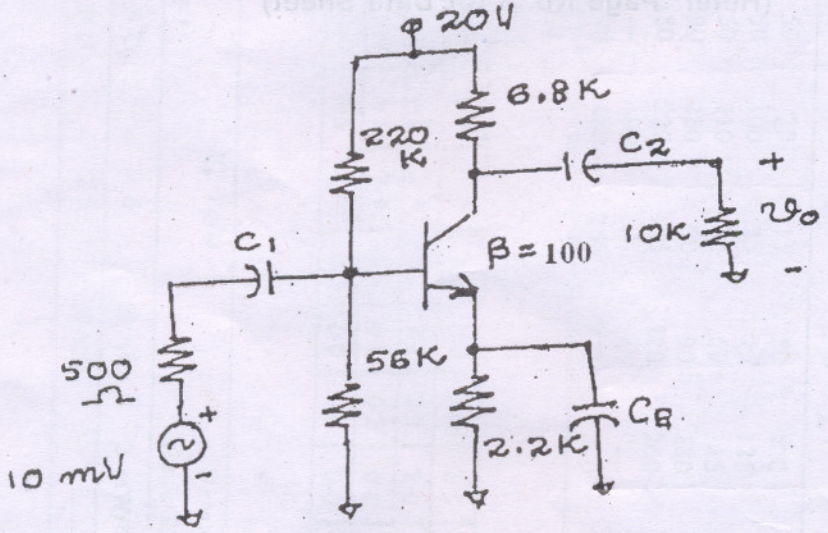
1. Attempt any **four** :– **20**
   (a) Explain the phenomenon of thermal runaway of BJ transistor.
   (b) Complete the sentence : The reverse saturation current of transistor _____ for every _____ °C rise in the C-B junction. Hence calculate the reverse saturation current of a transistor for junction temperature of 87°C if its reverse saturation current at 23°C is 10nA.
   (c) Prove that for a JFET the gate-source bias for zero temperature drift of drain current is at (Vp – 0·63) volts.
   (d) Compare CE and CS amplifiers.
   (e) Draw the circuit diagram of voltage multiplier circuit and explain its operation.

2. (a) Draw a circuit diagram of a full wave rectifier with 'C' filter. Derive expressions for ripple factor. Explain the basic rectifier operation. **10**
   (b) For the clipper circuit shown below sketch the waveforms for current I_R and voltage V_0. **10**



3. (a) Draw the common emitter r-π equivalent circuit of the BJ transistor with R_E <u>un-bypassed</u> and derive the expressions for – **10**
   (i) Input resistance
   (ii) Output resistance
   (iii) Voltage gain.

   (b) For the transistor circuit given below determine I_B, I_C, V_{CE}, V_{RE}. A_V and R_i **10**



4. Design a single stage RC coupled CE amplifier to meet the following specifications : **20**
   (a) V_0 peak = 3 V
   (b) $|A_v| >= 120$; S = 8; f_L better than 10 Hz.
   (c) R_i = 3 k Ω.

   Choose a suitable transistor with proper justification from the data sheet.

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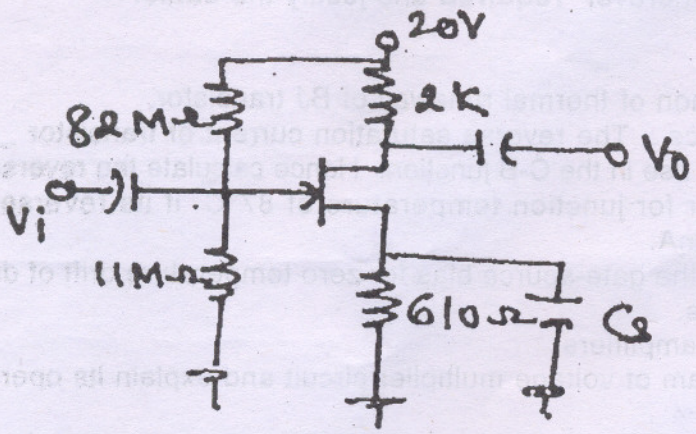
5. (a) Draw the neat circuit diagram of a JFET amplifier with source resistance by passed and derive the expression for the voltage gain. **10**

(b) Determine for the circuit below, I_D, V_{DS}, V_{GS}, A_v, Z_1, and Z_0. **10**
Determine Z_1, Z_0 and V_0 for circuit shown if V_1 = 20 mV.



I_{DSS} = 12 mA, V_p = − 3V γ_d = 100 kΩ.

6. Design a single stage AC coupled CS amplifier using BFWI 1 to meet following specifications. **20**
$|A_v|$ = 9 output voltage V_0 = 2·5 V(rms). With biasing circuit to give.

(a) Zero temperature draft

(b) To operate FET at $I_{DC} = \frac{I_{DSS}}{2}$.

7. Write short notes on (any **three**) :— **20**

(a) EMOSFET and DMOSFET (Construction, operation and V/I Characteristics)

(b) Photovoltaic Cells and Photo Diodes

(c) 3 biasing methods of BJ transistors and their stability factors.

(d) Zener diode : Principle of operation, V/I Characteristics, Application and typical circuits.

(Refer Page No. 3 for Data Sheet)

DBEC 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 min	typ.	max.	Small Signal min.	typ.	h_{fe} max.	V_{BE} max.	θ_{j_c} °C/W	Derate above 25°C W/°C
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	hie	hoe	hre	θja
BC 147A	2·7 K Ω	18μ ℧	1·5 × 10^{-4}	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	3·2 × 10^{-4}	—
BC 147B	4·5 K Ω	30μ ℧	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

−Vgs 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
Ids 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
Ids 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
Ids 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_{fs} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{j_a}
2N3822	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