Sem III Etan Electronic Circuit Analysis & Design-I 25/5/06

Con. 1757-06. (REVISED COURSE) TV-7959
(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. Give reasons for any **five** of the following :— 20

(a) Thermal runaway is of importance in BJT amplifiers but not so in FET amplifiers.

(b) Bleeder resistance is required when LC filter is used.

(c) FET is called as a square Law device.

(d) An ordinary rectifier diode does not work properly at high frequencies.

(e) Inverse active β is lower than normal active β.

(f) Common Base amplifier has largest bandwidth.

(g) Fixed bias circuit for BJT amplifier yields lowest stability of the dc operating point Q.

2. (a) How will you use a constant current source for uniform biasing of multiple devices ? Draw a circuit diagram, explain its operation, derive necessary design equations. 10

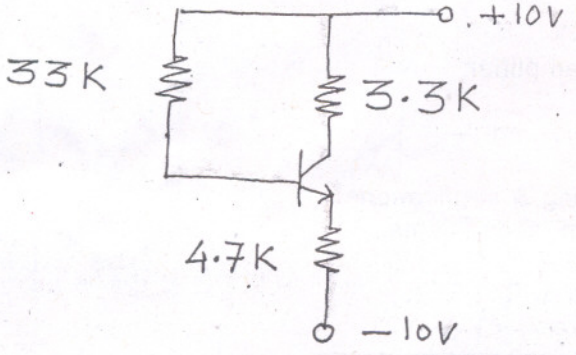
(b) A Full wave rectifier using center tapped transformer with two diodes gives output DC voltage of 250V to a resistive load, the current being 75 $\pm$ 25 mA. If the ripple factor is 0.01, calculate the specifications of the devices and components required if the filter used is L section (LC) filter. 10

3. (a) For the circuit shown in figure, 10

(i) Find the co-ordinates of operating point Q.

(ii) Calculate thermal stability factor S_{ICO} & Classify the given biasing circuit.

(iii) Draw dc Load line & show Q point on it.



Assume,
$\beta = 100$,
Si transistor.

(b) Draw circuit diagram of an emitter follower. Derive expressions for current gain Ai, Input resistance Ri, Output resistance Ro and voltage gain Av. State its important applications. 10

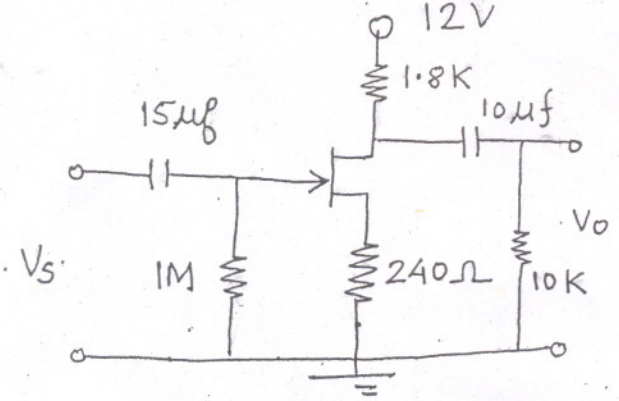
4. (a) Design a single stage RC coupled (Samplifier using FET BFWII biased at mid point to satisfy following specifications. **12**

Voltage gain Av = 10,

Lower cut off frequency FL = 20Hz,

Vo = 2.5v

(b) For the amplifier shown in figure , find Av, Ri & Ro. **8**



Assume,

$I_{DSS} = 8mA$,

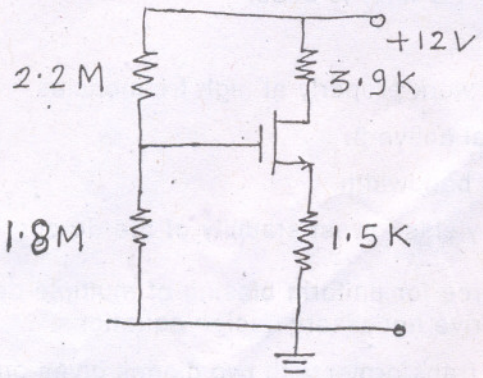
$|V_{GS\,off}| = 3V$,

$r_d = 50K\Omega$,

$I_{DQ} = 3.8\,mA$

5. (a) Draw a circuit diagram of MOSFET amplifier with active load & discuss its analysis. State the advantages of an active load. **10**

(b) Determine the coordinates of operating point Q and State the region of operation of the transistor on output characteristics for the circuit below. **10**



Assume,

$K_n = 0.5\ mA/V^2$,

$V_T = 2V$

6. Design a single stage RC coupled CE amplifier using transistor with following specifications. The amplifier must have **20**

$|Av| = 180$,

$S_{ICO} \leq 8$,

Vo = 3V, Vcc = 18V, FL ≤ 20Hz.

Assume hfe = hFE = 220, hie = 2.7 kΩ,

V_{CE} (sat.) = 0.25v. Neglect hve & hoe.

Calculate Av, Ri & Ro for the designed amplifier.

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

(a) Base width Modulation.
(b) Diode clipping circuit — working & applications.
(c) Avelench and Zener breakdown mechanisms.
(d) Solar Cell.
(e) Condition for zero temperature drift in FET.

ECAD 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 ℧	$1·5 \times 10^{-4}$	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	$3·2 \times 10^{-4}$	—
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