

(Time: 3 Hours)

Total Marks : 80



N.B.: (1) Question No. 1 is compulsory.

(2) Attempt any three questions out of remaining five.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if required and mention the same in answer sheet.

Q.1 Solve any four

(20)

- Draw and explain operation of Depletion type MOSFET.
- Compare RC coupled, TC coupled and DC coupled amplifier.
- Explain design consideration of heat sinks in power amplifier.
- Give the advantages of negative feedback.
- State and explain Barkhausen's Criteria.

Q.2 (a) Design a two stage RC coupled CE Amplifier to meet following specifications:

(15)

$A_v \geq 1000$ ,  $V_o = 4V$ ,  $S = 10$ ,  $f_L = 20$  Hz. Select BC147B.

(b) Explain the effect of source and load resistance on amplifier.

(05)

Q.3 (a) Draw circuit diagram of Class B Push Pull Power amplifier and explain its working. Find its maximum efficiency and maximum power dissipation in each transistor. What is cross-over distortion? How it can be overcome?

(10)

(b) Draw and explain Cascode amplifier in detail.

(10)

Q.4 (a) Design a class A transformer coupled power amplifier for the following requirements:

Output A.C. power = 5 watts, Load resistance = 12 ohms, DC supply voltage = 12 volts  
 $S_{ICO} \leq 8$ . Calculate overall efficiency at full load.

(10)

(b) Explain the different types of biasing of Depletion MOSFET.

(10)

Q.5 (a) Explain the different feedback topologies in detail.

(15)

(b) Write a short notes on Darlington pair amplifier.

(05)

Q.6 (a) Draw RC phase shift oscillator using BJT and derive the frequency of oscillation for same.

(15)

(b) For Hartley oscillator calculate the frequency of oscillation if  $L_1 = L_2 = 1$  mH and  $C = 0.2$   $\mu F$ .

(05)

Transistor type	P <sub>dmax</sub> @ 25°C Watts	I <sub>cmax</sub> @ 25°C Amps	V <sub>ce(sat)</sub> volts d.c.	V <sub>ces</sub> volts d.c.	V <sub>ces</sub> (Sus) volts d.c.	V <sub>ces</sub> (Sus) volts d.c.	V <sub>ces</sub> volts d.c.	V <sub>ces</sub> volts d.c.	T <sub>j</sub> max °C	D.C. current		Small Signal		h <sub>FE</sub> max.	V <sub>BE</sub> max.	θ <sub>JC</sub> °C/W	Derate above 25°C W/°C	
										min	typ.	max.	min.					typ.
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 <sub>ie</sub>	h <sub>oe</sub>	h <sub>re</sub>	g <sub>fs</sub>
BC 147A	2.7 K Ω	18 μ S	1.5 × 10 <sup>-4</sup>	0.4°C/mw
2N 525 (PNP)	1.4 K Ω	25 μ S	3.2 × 10 <sup>-4</sup>	—
BC 147B	4.5 K Ω	30 μ S	2 × 10 <sup>-4</sup>	0.4°C/mw
ECN 100	500 Ω	—	—	—
ECN 149	250 Ω	—	—	—
ECN 055	100 Ω	—	—	—
2N 3055	25 Ω	—	—	—

BFW 11—JFET MUTUAL CHARACTERISTICS

-V <sub>GS</sub> 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 <sub>DS</sub> max. mA	10	9.0	8.3	7.6	6.8	6.1	5.4	4.7	3.1	2.2	2.0	1.1	0.5	0.0
I <sub>DS</sub> 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 <sub>DS</sub> 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 <sub>GS</sub> MAX. Volts	V <sub>DS</sub> MAX. Volts	V <sub>GS</sub> MAX. Volts	P <sub>d</sub> MAX. @25°C	T <sub>j</sub> MAX.	I <sub>DS</sub>	g <sub>fs</sub> (typical)	-V <sub>p</sub> Volts	r <sub>d</sub>	Derate above 25°C	θ <sub>JC</sub>
1N3822	50	50	50	300 mW	175°C	2 mA	3000 μ S	6	50 KΩ	2 mW/°C	0.59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5500 μ S	2.5	50 KΩ	—	0.59°C/mW