Paper / Subject Code: 40103 / Linear Integrated Circuits

S.E. (BioMed) | Sem IV / Choice based.

[Time: 3 Hours] **[Marks:80]**

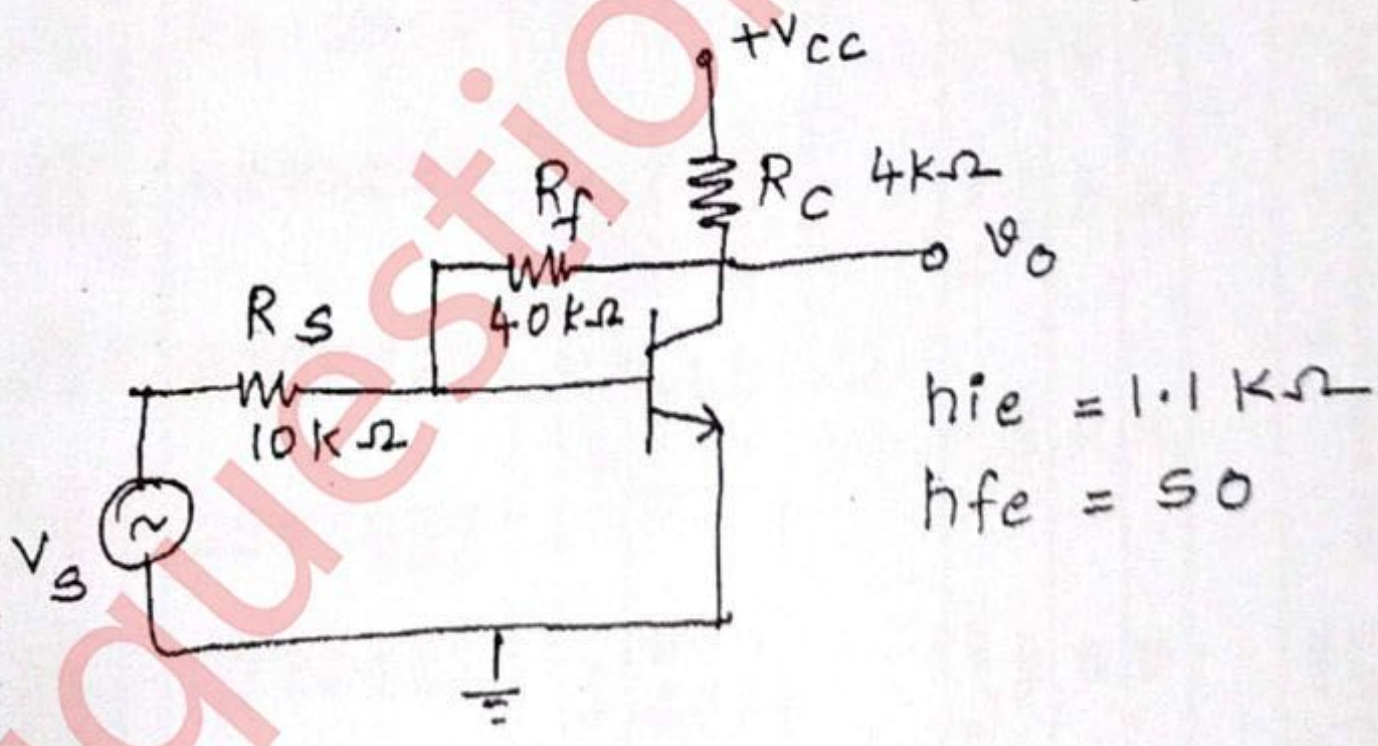
Please check whether you have got the right question paper.

N.B:
1. Question no one is compulsory.
2. Attempt any three questions from the following.
3. Assume suitable data wherever necessary.

Q.1
a) Give characteristics of negative feedback. (05)
b) Design RC-phase shift oscillator for 10 kHz frequency. (05)
c) Compare class-A, class-B and class-C of power amplifier. (05)
d) Draw and explain block diagram of op-amp. (05)

Q.2
a) Derive expression of gain for instrumentation amplifier and design it for variable gain from 2 to 300. (10)
b) Describe working of precision full wave rectifier using op-amp. Draw input-output waveforms (10)

Q.3
a) Calculate Av_f, Rin_f and R'_{of}. (12)



b) Give Barkhausen's criteria for oscillations. Derive expression for resonant frequency for Hartley osc. (08)

Q.4
a) Draw class-B push pull power amplifier and discuss its working. Derive expression for power dissipation in transistor, efficiency and figure of merit. Also, give its demerits. (10)
b) Design circuit using op-amp to satisfy following equation. (10)

$$V_0 = -100 \int (v_a + 2v_b - 4v_c - 3v_d)dt.$$

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Q.5 a) Derive equations for A_d , A_c , CMRR, Rin and Ro for Dual Input Unbalanced Output Differential Amplifier. Calculate their values if supply = $\pm$ 13V , $R_s = 1K\Omega$, $R_C = 2.7K\Omega$, $R_E = 7.6\ K\Omega$, $h_{fe} = 120$, $V_{BE} = 0.6V$. (15)

b) Discuss working of clamper using op-amp.

Q.6 a) Design class – A transformer coupled power amplifier for $P_L = 3W$, $R_L = 3\Omega$, $V_{CC} = 18V$, $S \leq 10$. (05)

b) Design differentiator that will differentiate an input signal with $f_{max} = 100Hz$. Draw the output waveform if the input is sinewave of 1V peak at 100Hz (12)

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S.E. (Biomed) / Sem III / Choice based

DBEC 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} (S_{KS}) volts d.c.	V_{CES} (S_{KS}) volts d.c.	V_{CEX} volts d.c.	V_{EBO} volts d.c.	T_j max °C	D.C. current gain min	typ.	max.	Small Signal min.	typ.	max.	h_{fe}	V_{BE} max.
2N3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120		1·8
ECN055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125		1·5
ECN149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115		1·2
ECN100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280		0·9
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260		0·9
2N525(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	oja
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

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
Ios 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
Ios 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
Ios 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

N-Channel JFET

Type	V_{ds} max. Volts	V_{oo} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{fs}	$-V_p$ Volts	r_d	Derate above 25°C
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μΩ	6	50 KΩ	2 mW/°C
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5000 μΩ	2·5	50 KΩ	—

UJT type	P_d max. @25°C	I_E max. @25°C	I_p peak pulse current max.	V_{B2E} Volts max.	V_{B2B1} Volts	T_j max	η min.	η max.	R_{BB} KΩ min.	R_{BB} KΩ typ.	I_v Max.	I_p max.	μA
2N2646	300mW	50mA	2Amp.	30	35	125°C	0·56	0·75	4·7	7·0	9·1		5·0