

Dr: 25/5/17

D2

S.E- Sem-IV (OLD) ETRX

Q.P. Code :10588

[Time: 3 Hours]

[Marks:100]

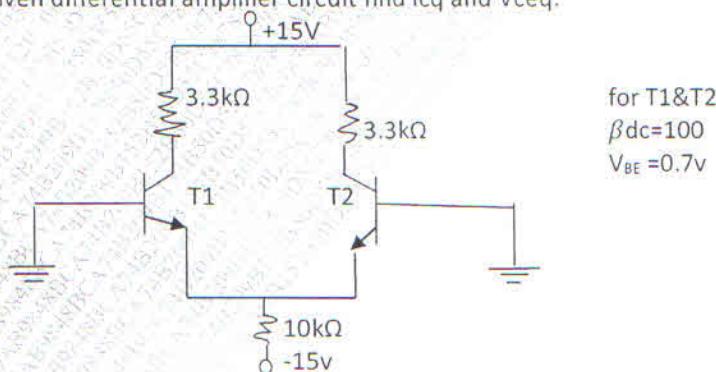
(OLD COURSE)

Please check whether you have got the right question paper.

- N.B: 1. Question-1 is compulsory; solve any FOUR from remaining questions.
 2. Assume suitable data if it is required.
 3. Draw neat and clean diagrams.

Q-1 Solve any FOUR

- a. How internal capacitances affects high frequency response of the amplifier. 05
 - b. What should be the relationship between gain of the amplifier and gain of feedback network in oscillator circuit? 05
 - c. Explain Cross over distortion in Power amplifier. 05
 - d. How CMRR can be increased in Differential amplifier. 05
 - e. Give the possible cascade stages for the following. 05
 - 1) Very high R_i and Very High A_v
 - 2) Very High R_i and very high A_i
 - f. How feedback amplifier is less sensitive to noise. 05
- Q-2 Design Two stage CE-CE amplifier for the following specifications 20
 $A_v \geq 1200$, $S_{ICo}=10$, $f_l=20\text{Hz}$, Use suitable transistor from the data sheet.
- Q-3 a. Design transformer coupled Class A Power Amplifier to give output power of 10 W to a load of 10Ω . 10
 b. Draw circuit diagram of Colpitt Oscillator; hence explain its working and applications. 10
- Q-4 a. Explain Low frequency response of an BJT amplifier. 10
 b. Explain working and principle of Crystal Oscillator. 10
- Q-5 a. Explain different types of Power amplifier in brief. 10
 b. For the given differential amplifier circuit find I_{CQ} and V_{CEQ} . 10



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- Q-6** a Derive equation of overall A_v , R_i and R_o for CS-CS multistage amplifier.
 b Give different topologies of negative feedback amplifier.

- Q-7** Write short notes on any FOUR

- Current Shunt Feedback amplifier
- Use of Coupling capacitors
- Darlington Pair
- constant Current source in Differential amplifier
- Clapp Oscillator

10
10

20

Q.P. Code :10588

Transistor type	P_{dmax} @ 25°C Watts	I_{cmos} @ 25°C Amps.	V_{CEPmax} volts d.c.	V_{ceo} volts d.c.	V_{ceo} (Sus) volts d.c.	V_{cep} (Sus) volts d.c.	V_{ceo} volts d.c.	V_{ceo} volts d.c.	T_{jmax} °C	D.C. current, min.	gain typ.	Small signal typ.	f_{t} max.	V_{be} max.	θ_{CW}	Derrate above 25°C W/C	
2N 3065	115.5	15.0	1.1	100	60	70	90	7	200	20	50	70	15	50	120	1.8	1.5
ECN 055	50.0	5.0	1.0	60	50	55	60	5	200	25	50	100	28	75	125	1.5	3.6
ECN 149	30.0	4.0	1.0	50	40	-	-	8	150	30	50	110	33	60	115	1.2	0.7
ECN 100	5.0	0.7	0.6	70	60	65	-	8	200	50	90	280	50	90	200	0.9	0.3
BC 147A (PNP)	0.25	0.1	0.25	50	45	50	-	8	125	115	100	220	125	220	200	0.9	0.05
BC 147 A (NPN)	0.225	0.1	0.25	85	30	-	-	100	35	-	65	-	45	-	-	-	-
BC 147 B	0.25	0.1	0.25	50	45	50	-	8	125	200	250	450	240	330	500	0.9	-

Transistor type	h_{ie}	h_{oe}	h_{re}	θ_{ja}
BC 147 A	2.7kΩ	18μmho	1.5×10^{-4}	0.4°C/mW
2N 525 (PNP)	1.4kΩ	25μmho	3.2×10^{-4}	-
BC 147B	4.5kΩ	30μmho	2×10^{-4}	0.4°C/mW
ECN 100	500	-	-	-
ECN 149	150	-	-	-
ECN 056	120	-	-	-
2N 3065	8 Ω	-	-	-

BPW 11-JFET MUTUAL CHARACTERISTICS

$-V_{\text{ce}}$ Volts	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.5	2.0	2.4	2.5	3.0	3.5	4.0
I_{ce} 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_{ce} typ mA	7.0	6.0	5.4	4.8	4.0	3.3	2.7	1.7	0.8	0.2	0.0	0.0	0.0	0.0
I_{ce} min mA	4.0	3.0	2.2	1.5	1.0	0.5	0.0	0.0	0.0	—	—	—	—	—

N-Channel JFET

Type	V_{DSmax} Volts	V_{DZmax} Volts	V_{GSmax} Volts	P_{dmax} @ 25°C mW	T_{jmax} °C	I_{ds}	R_{ds} (Typical)	$-V_{\text{p}}$ Volts	r_{s}	Derrate above 25°C	θ_{JC}
2N2822	50	50	50	300 mW	175°C	2 mA	3000 μ mho	8	50 kΩ	2 mW/°C	0.59°C/mW
BEW 11 (Gated)	30	30	30	300 mW	200°C	7 kA	5000 μ mho	2.5	50 kΩ	—	0.59°C/mW

15 May, 2017

(3 Hours)

[Total marks : 100]

Please check whether you have got the right question paper.
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Note :-

- 1) Question No. 1 is compulsory.
- 2) Attempt any four questions from the remaining six questions.
- 3) Figures to the right indicate full marks.
- 4) Use of statistical table is permitted.

Q.1 a)

If $A = \begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$, find the characteristic roots of A^3 .

05

b)

By using residue theorem evaluate $\int_C \frac{\sin \pi z}{(z - \pi/6)^3} dz$ where C is $|z| = 1$.

05

c)

Is the following function injective, surjective?

$$f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = 2x^2 + 5x - 3$$

05

d)

Find the probability that at most 4 defective bulbs will be found in a box of 200 bulbs if it is known that 2 percent of the bulbs are defective.
(Given: $e^{-4} = 0.0183$)

05

Q.2 a)

If R is the set of all real numbers other than zero and if $a * b = 2ab$, prove that $(R, *)$ is an Abelian group.

06

b)

Find the residues of $f(z) = \frac{\sin \pi z}{(z-1)^2(z+2)}$ at its poles.

06

08

A random variable X has the following probability mass function:

	x	-2	0	3	1
	$P(X=x)$	1/3		1/2	1/6

Find (i) first four raw moments, (ii) first four central moments.

Q.3 a)

Find the Laurent's series for $f(z) = \frac{4z+3}{z(z-3)(z+2)}$ valid for $2 < |z| < 3$.

06

b)

Let $A = \{1, 2, 3, 5, 6, 10, 15, 30\}$ and R be the relation 'is divisible by'. Obtain the relation matrix and draw the Hasse diagram.

06

c)

Show that the matrix $A = \begin{pmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{pmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix.

08

- Q. 4** a) Monthly salary X in a big organization is normally distributed with mean Rs. 3000 and standard deviation of Rs. 250. What should be the minimum salary of a worker in this organization, so that the probability that he belongs to top 5% workers? **06**
- b) A probability distribution of a random variable X is given by
- | | | | | | | |
|------------|-----|-----|-----|------|-----|-----|
| X | -2 | -1 | 0 | 1 | 2 | 3 |
| $P(X = x)$ | 0.1 | K | 0.2 | $2K$ | 0.3 | K |
- Find K , mean and variance.
- c) Find e^A and 4^A if $A = \begin{pmatrix} 3/2 & 1/2 \\ 1/2 & 3/2 \end{pmatrix}$ **06**
- Q. 5** a) A random sample of 50 items gives the mean 6.2 and standard deviation 10.24. Can it be regarded as drawn from a normal population with mean 5.4 at 5% level of significance? **06**
- b) Determine whether the set A of all ordered pairs (a, b) of real numbers ($a \neq 0$) under $*$ defined by $(a, b) * (c, d) = (ac, bc + d)$ is an Abelian group. **06**
- c) Evaluate $\int_C \frac{z^2+3}{z^2+2z+5} dz$, where C is the circle. **08**
- (i) $|z| = 1$ (ii) $|z+1-i| = 2$
- Q. 6** a) If $A = \begin{pmatrix} 2 & 1 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$ find the characteristic roots and characteristic vectors of $A^2 + I_3$. **06**
- b) Let $B = \{1, 5, 14, 70\}$. Let $a \vee b = \text{l.c.m. } \{a, b\}$ and $a \wedge b = \text{g.c.d. } \{a, b\}$. **06**
- $a = \frac{1}{14}$. Prove that $(B, \vee, \wedge, \neg, 0, 1)$ is a Boolean algebra. **08**
- c) Let X be a continuous random variable with probability density function $f(x) = kx(1-x)$, $0 \leq x \leq 1$. Find k and determine a number b such that $P(X \geq b) = P(X > b)$. **08**
- Q. 7** a) Verify Cayley-Hamilton theorem for the matrix A and hence, find A^{-1} where $A = \begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$ **06**

- b) In a distribution exactly normal 7% of items are under 35 and 89% are under 63. What are the mean and standard deviation? **06**
- c) Investigate the association between the darkness of eye colour in father and son from the following data: (Level of significance is 5%) **08**

Colour of father's eyes → Colour of son's eyes ↓	Dark	Not dark	Total
Dark	48	90	138
Not dark	80	782	862
Total	128	872	1000