Q.P. Code :08288

[Time: 3 Hours]   [Marks:100]

Please check whether you have got the right question paper.

N.B: 1. **Question No. 1 is compulsory.**
        2. **Answer any four out of remaining six questions.**
        3. **Assume any suitable data wherever required.**

Q.1   Answer any Four of the following:-
        a) Derive the condition for zero temperature drift biasing in JFET.   05
        b) Draw and explain negative clamper circuit.   05
        c) Explain the phenomenon of thermal runaway in BJT.   05
        d) Compare CE BJT and CS FET amplifiers.   05
        e) Compare "L" and "C" filter.   05

Q.2 a) Draw the circuit of full wave rectifier with "LC" filter and explain its working. Derive   10
        expression for ripple factor.

     b) For the clipper circuit shown below sketch the waveform of output voltage and justify it.   10

$Vi=10vpp$, sine wave
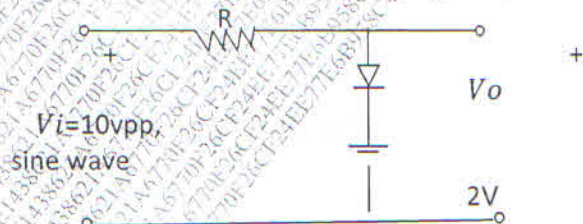
Q.3   Design a single stage RC coupled CE amplifier to meet the following specifications: 20
        $Vo=2v, |Av|=90, S=8, F_L= 20Hz$. Determine Av, Zi and Zo for the designed circuit. Choose a
        suitable transistor with proper justification from the data sheet.

Q.4 a) For the circuit shown below determine I_B, I_C, V_{CE}, V_{RE}, A_v and R_l. Assume $\beta=90$.   10

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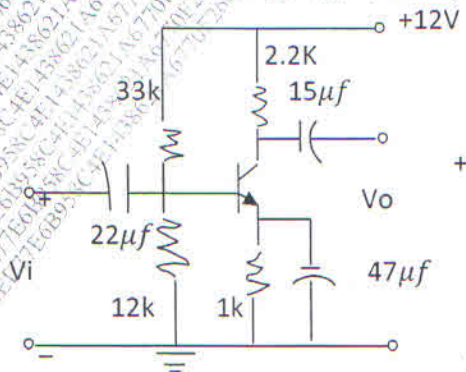
b) Define Transistor Biasing. State and compare various types of biasing circuits of BJT as a voltage amplifier.   10

Q.5 a) Draw neat circuit diagram of CS FET amplifier and explain its working. Derive the expressions for Z_I, Z_O and A_V.   10

b) For the circuit shown below, determine V_{GSQ}, I_{DQ} and V_{DSQ}.   10

+20V

3.3KΩ

Assume,
I_{DSS}=6Ma;
V_p=-4V

Vi   1MΩ   1KΩ
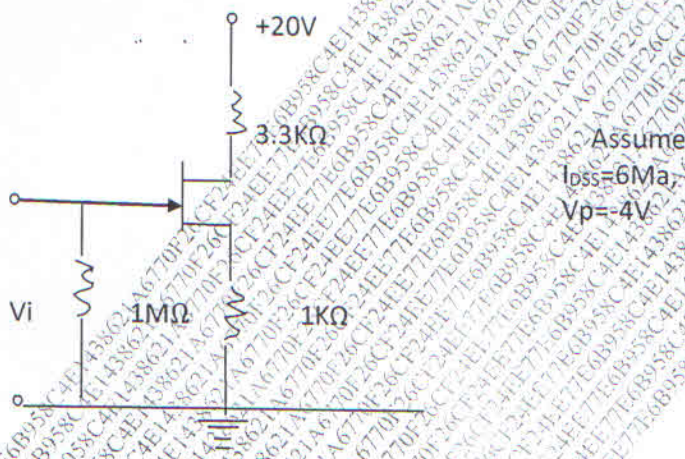
Q.6 Design a single stage RC coupled CS amplifier to meet the following specifications: V_O = 2.5V, $|A_V|$ =10, F_L = 20Hz. Use BFW11. Determine A_V, Z_i, $V_{O(MAX)}$ and Z_O for the designed circuit.   20

Q.7 Write short notes on any three of the following :-   20
a) Photodiode and photovoltaic cell.
b) Various biasing schemes for E-MOSFET.
c) Hybrid π equivalent circuit of BJT.
d) Comparison of CE, CB and CC amplifiers.

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DATA SHEET

Transistor type	Pdmax @25°C Watts	Icmax @25°C Amps	Vce(sat) volts d.c.	Vcbo volts d.c.	Vceo (Sus) volts d.c.	Vcb (Sus) volts d.c.	Vceo volts d.c.	Vcbo volts d.c.	Tj max °C	D.C. current gain min	typ.	max.	Small Signal min.	typ.	hfe max.	Vsat max.	θj/c °C/W	Der. abo 25° 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
ECV 055	50.0	5.0	1.0	60	50	55	60	5	200	25	50	100	25	75	125	1.5	3.5	0
ECV 149	30.0	4.0	1.0	50	40	—	—	8	150	30	50	110	33	60	115	1.2	4.0	0
ECV 100	5.0	0.7	0.6	70	60	65	—	6	200	50	90	280	30	90	280	0.9	3.5	0
BC147A	0.25	0.1	0.23	50	45	50	—	6	125	115	180	220	125	220	260	0.9	—	0.4
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 KΩ	18μ℧	1.5 × 10⁻⁴	0.4°C/mw
2N 525(PNP)	1.4 KΩ	25μ℧	3.2 × 10⁻⁴	—
BC 147B	4.5 KΩ	30μ℧	2 × 10⁻⁴	0.4°C/mw
ECV 100	50 Ω	—	—	—
ECV 149	15 Ω	—	—	—
ECV 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	Vds max. Volts	Vdc max. Volts	Vds max. Volts	P max. @25°C	Tj max.	Idss	gm (typical)	rd	-Vp Volts	Derate above 25°C	θja
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ℧	50 KΩ	6	2 mW/°C	0.59°C/m
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ℧	50 KΩ	2.5	—	0.59° C/m

SEM-III - ETRX OLD.
Engg Maths-III

(3 HOURS)

MARKS:100

N.B. (i) Question no. ONE is compulsory.

   (ii) Attempt any FOUR questions out of the remaining six questions.

   (iii) Figures to right indicate full marks.

Q. 1 (a) Find the analytic function $f(z) = u + iv$ if $3u + 2v = y^2 - x^2 + 16xy$ 5

   (b) Find Laplace Transform of $t^{-1} e^{-t} \sin t$ 5

   (c) Prove that $adj.adj.(A) = |A|^{n-1} A$ 5

   (d) Test for the consistency the following equations and solve them if they are consistant $2x - y + z = 9$, $3x - y + z = 6$, $4x - y + 2z = 7$, $-x + y - z = 4$ 5

Q.2 (a) Find the Fourier Series to represent $f(x) = x^2$ in $(0, 2\pi)$ 6

   (b) Prove that every Hermitian matrix A can be written as $B + iC$ where B is real symmetric C is real skew symmetric   6

   (c) Find Bilinear transformation which maps the points $z = 1, i, -1$ on to the points $w = i, o, -i$ 8

[TURN OVER

Q.3 (a) Obtain the Fourier series of xcosx in $(-\pi, \pi)$ 6

(b) Examine whether the vectors   [3,1,1] , [2,0,-1] , [4,2,1]   are linearly   6
dependent.If so find the relation between them.

(c) Solve using Laplace Transorm $(D^2 +2D +5)y = e^{-t} \sin t$, when $y(0) = 0$ 8
,y'(0) = 1

Q.4 (a) Obtain the expansion of $f(x) = x (\pi - x)$, in $(0 , \pi)$ as half range cosine   6
series.

(b) Obtain the complex form of Fourier Series for $f(x) = e^{ax}$ in $(-\pi, \pi)$ 6

(c)
Reduce the matrix to normal form and find its rank. $\begin{bmatrix} 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \end{bmatrix}$ 8

Q.5 (a) Using Laplace transform evaluate $\int_0^\infty e^{-t} \int_0^t u \cos^2 u \, du \, dt$ 6

(b)
Verify laplace equation for $u = (r + \dfrac{a^2}{r}) \cos\phi$ also find v and f(z)   6

(c)
Under the transformation $w = \dfrac{z-1}{z+1}$ find the image of straight line y = x   8

[TURN OVER

- 2 -

Q.6 (a) Find inverse Laplace transform of $\tan^{-1}\left(\dfrac{2}{s}\right)$ 6

(b) If $A = \dfrac{1}{3}\begin{bmatrix} 1 & 2 & a \\ 2 & 1 & b \\ 2 & -2 & c \end{bmatrix}$ is orthogonal find a , b ,c   6

(c) Find Fourier Cosine Integral prove that $e^{-x}\cos x$, $-\infty < x < \infty$ 8

Q.7 (a) Show that the set of functions $\cos nx$, $n = 1,2,3,\ldots\ldots\ldots$ is orthogonal on $(0 , 2\pi)$.Hence ,construct orthonormal set of functions.   6

(b) Find the orthogonal trajectory of the family of curves $x^3 y - xy^3 = c$ 6

(c) For what value of k , the following system of equations possesses a non-trivial solution ? Obtain the solution for real value of k.   8

$3x + y - k z = 0$, $4x - 2y - 3z = 0$, $2kx + 4y - k z = 0$

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