SE | EXTC | IV (REV.) 26/11/12

A.M. IV

P4–RT–Exam.–Oct.–12–79

Con. 7901–12. **KR–7043**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory.**
(2) Attempt any **four** questions from Q.2 to Q.7.

1. (a) Find the analytic u + iv given $u + v = e^x (\cos y + \sin y) + \frac{x-y}{x+y}$. **5**

(b) The matrix A is given by $A = \begin{bmatrix} 1 & 0 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$. Find the eigen values and eigen vectors of B where $B = I - 6A^{-1}$. **5**

(c) Evaluate $\int_c \bar{f} \cdot d\bar{r}$ along the arc of the curve from the point (1,0) to $(e^{2\pi},0)$ where $\bar{f} = \frac{xi+yj}{(x^2+y^2)^{3/2}}$ and curve C is $\bar{r} = e^t \cos t\, i + e^t \sin t\, j$. **5**

(d) Prove that $\int J_3(x)dx = -\frac{2}{x}J_1(x) - J_2(x)$. **5**

2. (a) Find the Bilinear transformation which maps 1, –1, ∞ onto 1+i, 1–i, 1. Find its fixed points. **6**

(b) Evaluate A^{100} for $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$. **6**

(c) Verify Green's theorem for $\bar{f} = (x^2 - xy)i + (x^2 - y^2)j$ and c in Δ^{le} with vertices (0,0), (1,1) & (1,–1). **8**

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3. (a) Show that $f(x) = x^2$, $0 < x < 2$, $f(x) = \sum_{i=1}^{\infty} \frac{2(\lambda_i^2 - 4)}{\lambda_i^3 J_1(\lambda_i)} Jo(\lambda_i x)$ where λ_i, $i = 0, 1, 2, \ldots$ are roots of $Jo(\lambda) = 0$ 6

(b) Show that $\frac{x}{x^2+y^2} + 2\tan^{-1}\left(\frac{y}{x}\right)$ is imaginary part of an analytic function. Find its real part and hence find the analytic function. 6

(c) Evaluate $\int_c \frac{z^2}{z^4-1} dz$, 8

c is (i) $|z-1| = 1/2$ (ii) $|z-1| = 1$ (iii) $|z+i| = 1$.

4. (a) Evaluate using stokes theorem $\int_c y\,dx + z\,dy + x\,dz$, where C is the curve of intersection of surfaces $x^2 + y^2 + z^2 = a^2$ and $x + z = a$. 6

(b) Evaluate $\int_0^{\infty} \frac{1}{x^4+1} dx$. 6

(c) Find an orthogonal transformation which reduces the quadratic form $2x^2 + y^2 - 3z^2 - 8yz - 4xz + 12xy$ to a diagonal form. Find the rank, index, signature and class value of the given form. 8

5. (a) Prove that $J_{3/2}(x) = \sqrt{\frac{2}{\pi x}}\left(\frac{\sin x}{x} - \cos x\right)$. 6

(b) Find a minimal polynomial of A hence find 6

A^{10} where $A = \begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & 4 \end{bmatrix}$

(c) Find all possible Laurent's series expansion of $\frac{4z^2+2z-4}{z^3-4z}$ about $z = 2$ and specify their domain of convergence. 8

6. (a) Prove that $2J_n^1(x) = J_{n-1}^{(x)} - J_{n+1}^{(x)}$. 6

(b) Evaluate $\int_0^{2\pi} \frac{\cos 3\theta}{5-4\cos\theta}\, d\theta$ 6

(c) Verify Gauss divergence theorem for $F = xi + yj + z^2k$, s in the surface bounded by the cone $x^2 + y^2 = z^2$ and plane $z = 1$. 8

7. (a) Show that under the transformation $w = z^2$, the circle $|z-1| = 1$ is mapped onto cardiode $\rho = 2(1 + \cos\phi)$ where $w = \rho e^{i\phi}$ in w plane. 6

(b) Find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$ 6

where $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$.

(c) (i) State and prove the Cauchy residue theorem. 4

(ii) Evaluate $\int_c z^6 e^{-1/z^2}\, dz$; $c : |z| = 1$ 4

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EXTC Sem IV

Analog & Digital IC Design & App

AGJ–2nd half (f)–12–30

Con. 7850–12. **KR–7160**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **four** questions from the remaining **six** questions i.e. Q. No. 2 to Q. 7.
(3) **Figures** to the **right** indicate **full** marks.

1. (a) State and explain the important advantages of three op-amp instrumentation amplifier. **5**
   (b) Compare static RAM and dynamic RAM. **5**
   (c) Give the comparison between Melay machine and Moore machine. **5**
   (d) Draw and explain voltage and current converter. **5**

2. (a) With neat diagram explain two techniques of A to D conversion. **10**
   (b) Draw and explain the block diagram of IC 810 audio power amplifier in detail. **10**

3. (a) Design a Melay state machine for overall sequence detector for the string '1110'. The output must be 1 when the input matches this string :–
      (i) Draw the state diagram – **4**
      (ii) Write its transition and output table **4**
      (iii) Draw logic diagram. **4**
   (b) Draw and explain the diagram of IC 566 VCO and explain its features. **8**

4. (a) Write the VHDL Code for 8 bit shift right register. **10**
   (b) Using equal-components, design a second order band pass KRC filtter with $f_0 = 2kHz$ and BW = 400 Hz. What is its resonant ? **10**

5. (a) Draw a circuit of three op-amp Instrumentation amplifier and explain its working. Derive the output voltage equation. **10**
   (b) Explain in detail the vairous documentation standard of sequential circuits. **6**
   Draw the internal structure of synchronous SRAM. **4**

6. (a) Explain the operation of the sample and hold circuit. **6**
   Draw input and output waveforms. **4**
   (b) Design a mono stable multi-vibrator for pulse width of 1m/sec using timer IC 555 with power supply of 12 Volt. **7**
   Explain whether the pulse width will increase, decrease or remain same if the 0 Volt DC is applied at control pin of IC 555. **3**

7. Write short notes on (any **three**) :– **20**
   (a) Non-inverting Schmitt trigger
   (b) CPLD
   (c) Comparator Circuit
   (d) Structural Modeling.

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Sub. - EDC-II

4-p3-d-upq-SH KL12 B

Con. 7822–12.

KR–7271

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question Nos. **1** and **2** are **compulsory**.
(2) Answer any **three** from remaining questions.
(3) Figures to the **right** indicates **full** marks.
(4) Assume **suitable** data if **required**.

1. (a) Design two stage R-C coupled CE amplifier for the following specifications : Av $\geq$ 1600, V_0 = 3·2V. Use transistor BC 147A from data sheet (Assume for BJT hre = hoe = 0). **15**

   (b) For the above designed amplifier determine voltage gain input impedance, O/P impedance and total current supplied by source Vcc. **5**

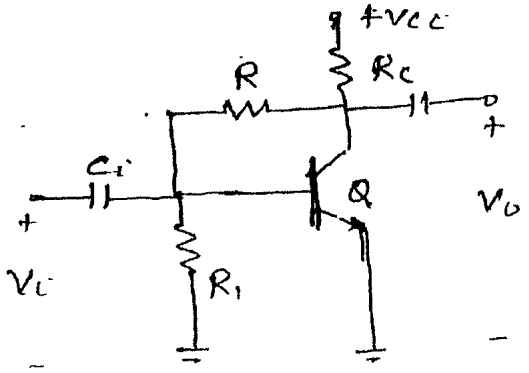
2. (a) Design class A transformer coupled power amplifier for the following specifications : peak output voltage 6V, load resistance RL = 6Ω and Supply voltage of 20V. **10**

   (b) For dual input balanced output differential amplifier analyze and derive the expression for (i) Differential mode gain (Ad) (ii) Common mode gain (Ac) (iii) CMRR (ρ). **10**

3. (a) A three stage RC coupled amplifier uses FET with the following parameters : gm = 2·6 mA/V. rd = 7·7 kΩ and R_D = 12 kΩ, R_G = 1MΩ, coupling capacitor is Cc = 0·005μf, Cs = ∞ . Evaluate— **10**
   (i) The overall mid-band voltage gain in dB
   (ii) Lower 3-dB frequency of individual stages
   (iii) Overall lower 3dB frequency of amplifier.

   (b) Discuss Darlington pair. What are its primary features ? Obtain expressions for, Av, Ai and Ri. **10**

4. (a) For the amplifier shown in **figure** Derive the expression for Avf, Aif, Rif and Rof using negative feedback approach. **12**



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(b) Explain the principle of working of Weinbridge oscillator circuit. Explain why negative feedback in addition to the usual positive feedback is employed in Weinbridge oscillator. 8

5. (a) An amplifier with negative feedback has an overall gain of 100. Variation of this gain of only ± 1 percent can be tolerated for some specific use. If the open loop gain variations of +10% are expected owing to production spreads in device characteristics, determine the minimum value of the feedback fraction B and also open loop gain to satisfy the above condition. 10

(b) Explain the practical cascode amplifier and derive the expression for Av, Ri and Ro. List the applications of cascode amplifier. 10

6. (a) Explain why a voltage amplifier cannot be used as a good power amplifier. 8

(b) With neat sketch, explain the working of an astable multivibrator. On what factors does the frequency of the output waves depend ? 12

7. Write short notes on the following (any **two**) :— 20

(a) Crystal oscillator and its applications

(b) Explain Low frequency response of Recoupled CE amplifier

(c) Hormonic distortion in power amplifier and prove that $P = [\ 1 + D^2\ ]\ P_1$.

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_{CEX} (Sus) volts d.c.	V_{CEV} 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.	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	0·03
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	500 Ω	—	—	—
ECN 149	250 Ω	—	—	—
ECN 055	100 Ω	—	—	—
2N 3055	25 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_{os} max. Volts	V_{oo} max. Volts	V_{os} max. Volts	P_d max. @25°C	T_j max.	I_{dss}	g_{os} (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

Con. 10503–12. **KR-7391**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data if **required**.

1. Answer the following : (any **four**) **20**
   (a) Explain why FM is more immune to noise
   (b) What is aliasing ? How can it be prevented ?
   (c) Define Noise factor and Noise figure.
   (d) Explain FM noise triangle.
   (e) What is the difference between noise and interference ? Explain different types of noise.

2. (a) Derive equation for total transmitted power, total side band power and single side band power for AM wave and draw freq. spectrum for DSBFC. **10**
   (b) The antenna current of AM broadcast transmitter modulated to the depth of 40% by an audio sine wave is 11 Ampere. It increases to 12 Ampere as a result of simultaneous modulation by another audio sinewave. What is the modulation index due to this second wave ? **10**

3. (a) Draw and explain Delta modulation transmitter and receiver. What is slope overload distortion ? **10**
   (b) Explain the following terms – **10**
      (i) Selectivity
      (ii) Fidelity
      (iii) Sensitivity
      (iv) Double spotting
      (v) Quantization.

4. (a) State and prove sampling theorem. **10**
   (b) Define FM and derive equation of FM wave. **10**

5. (a) Derive the Friss formula for calculations of total noise figure for two amplifiers connected in cascade. **10**
   (b) Explain the operation of Foster seely discriminator with the help of circuit diagram and phasor diagram. **10**

6. (a) Explain generation and demodulation of PAM signal with the help of suitable diagrams. **10**
   (b) Draw a neat block diagram of differential pulse code modulation transmitter and receiver and explain the same. **10**

7. Write short notes on the following :– **20**
   (a) Pre-emphasis and Deemphasis
   (b) Primary causes of ISI
   (c) Adaptive delta modulation
   (d) AGC.

S E. EXTC sem IV (Rev) Dec-2012

Sub:- EWT.

31 : 2nd half-12-(n) JP

Con. 11064-12.

KR–7616

(3 Hours) **[Total Marks :100**

N.B.: (1) Question No. **1** is **compulsory.**
(2) Attempt any **four** from remaining **six** questions.
(3) Assume **suitable** data if **necessary.**

1. Attempt any **four** questions :— **20**
   (a) State and explain Coulomb's law
   (b) Method of Images
   (c) Gauss's Law
   (d) Poynting Vector
   (e) Polarization of electromagnetic waves.

2. (a) Find electric field intensity due to a volume charge. **10**
   (b) Calculate the total charge within the volume **10**
   $0 \le \rho \le 0{\cdot}1, \quad 0 \le \phi \le \pi, \quad 2 \le z \le 4$ given $\rho_v = \rho^2 z^2 \sin 0{\cdot}6\phi$.

3. (a) A total charge of $\frac{40}{3}$ n C is uniformly distributed over a circular ring of radius 2m placed on z = 0 plane with center at origin. Find electric potential at (0, 0, 5). **10**
   (b) A vector field is given by : **10**

   $$A\ (r, \phi, z) = 30\ e^{-r}\ \hat{a}_r - 2z\ \hat{a}_z$$

   Verify divergence theorem for the volume enclosed by r = 2m, z = 0m and z = 5m.

4. (a) Explain Maxwells's equations in differential and Integral form for time-varying field. **10**
   (b) Derive V and $\vec{E}$ for a dipole situated at the origin on z axis. **10**

5. (a) Derive an expression for magnetic field intensity due to finite long straight element. **10**
   (b) Prove that static electric field is irrotation and static magnetic field is solenoidal. **10**

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6. (a) Derive Poisson's and Laplace's equation. **10**

   (b) Use Laplace's equation to find capacitance of a coaxial cable of inner radius 'a' and outer radius 'b' m, given $V = V_0$ at $r = a$ and $V = 0$ at $r = b$. **10**

7. (a) Derive general wave equations for $\vec{E}$ and $\vec{H}$ fields. **10**

   (b) A charge distribution with spherical symmetry has density **10**

$$\rho_v = \frac{\rho_0 r}{a} \text{ for } 0 \le r \le a$$

$$\rho_v = 0 \quad \text{for } r > a$$

Determine $\vec{E}$ everywhere.