27/12/11 S E EXTC IV (Rev) EWT

44 : 2nd half.11-AM(f)

Con. 6917-11. **MP-4378**

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

N.B. : (1) Question No. 1 is **compulsory**.
(2) Assume **suitable** data if **required.**
(3) Solve any **four** questions from **remaining** questions.
(4) **Figures** to the **right** indicate marks.

1. Explain any **four** of the following :— **20**
   (a) Polarization in Magnetic Materials.
   (b) Equation of Continuity.
   (c) Method of images.
   (d) Divergence theorem and its significance.
   (e) Modified form of Ampere's Circuital law.

2. (a) Three point charges 3, 4 and 5 coulomb are situated in free space at three corners of an equilateral triangle with sides 5 cm. Find the energy density due to electric field in the triangle. **10**
   (b) In the region of free space that includes the volume $2 < (x, y, z) < 3$, **10**
   $\overline{D} = \frac{2}{z^2}\left(yz\,\overline{a}_x + xz\,\overline{a}_y - 2xy\,\overline{a}_z\right)$. Verify the divergence theorem for D.

3. (a) A lossless dielectric medium has $\sigma = 0$, $\mu r = 1$ and $\varepsilon v = 4$. An electromagnetic wave has magnetic field components expressed as : **12**
   $\overline{H} = -0\cdot 1\cos(wt - z)\,\overline{a}_x + 0\cdot 5\sin(wt - z)\,\overline{a}_y$ A/m.
   (b) Find the inductance of coaxial cable of length L where inner conductor has radius a and outer has radius b. **8**

4. (a) Derive the wave equation from Maxwell's equations for free space, charge free region. **10**
   (b) A conductor of length 2·5 m located at Z = 0, X = 4m carries a current of 12A in the $\overline{a}_y$ direction. Find the uniform magnetic field in the region, if the force on the Conductor is : **10**
   $1\cdot 2 \times 10^{-2}$ N in the direction $(-\overline{a}_x + \overline{a}_z)/\sqrt{2}$

5. (a) Derive an expression for electric field intensity due to an infinite sheet of charge density K. **10**
   (b) Obtain the conditions that H and B must satisfy at the boundary between two different dielectric media. Region 1(y < = 0) consists of a magnetic material for which $\mu_{r1} = 2$, while region 2(y > = 0) is free space if — **10**
   $$\overline{B}_1 = 40\overline{a}_x - 50\overline{a}_y - 30\overline{a}_z \text{ mwb/m}^2$$
   Calculate $\overline{B}_2$.

6. (a) Explain Biot-Savart law. Determine magnetic field intensity H for the straight conductor carrying current for finite length. 10

(b) Derive Poission's and Laplace's equation. Use Laplace's equation to find capacitance per unit length of a coaxial cable of inner radius 'a' and outer radius 'b' m. 10

Assume $V = V_0$ at $r = a$ and $V = 0$ at $r = b$.

7. (a) Explain the concept of Scalar and Vector magnetic potential. 10

(b) A charge configuration is given by :— 10

$Q_y = 5_{re}^{-2r}$ C/m^3. Find D using Guass's law.

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SE EXTC Sem - IV
EDC - II

Con. 6521-11.

MP–4375

(3 Hours)

[Total Marks : 100

N.B. : (1) Question No.1 and 2 is **compulsory**.
(2) Answer any **three** from remaining questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume **suitable** data if **required**.

Q1. (a) Using transistor BC147B design two stage R-C coupled amplifier for the following parameters: 15
$Av \geq 2200$, $Ri > 5K\Omega$, $Vo=3V$.,

(b) For the above designed amplifier determine; voltage gain, input impedance, output impedance, current supplied by source Vcc. 05

Q2. Using BFW 11 design two stage R-C coupled CS amplifier to meet the following specifications. 20
$Av \geq 110$, $f_L \leq 20Hz$, $Vo=4V$

Q3. (a) A three stage RC coupled amplifier uses FET with the following parameters: $g_m=2.5$ mA/V, $r_d=50k\Omega$, $R_D=5.7k\Omega$, $R_G=1M\Omega$, coupling capacitor $Cc=0.005\mu f$ and shunt capacitor is $Csh=$ 50 pf and $Cs=\infty$. Evaluate 10
i) The overall mid-band voltage gain in dB
ii) Lower 3-dB frequency of individual stages and overall lower 3-db frequency.
iii) Higher 3-dB frequency of individual stages and overall higher 3-db frequency.

(b) Discuss biasing problem in Darlington pair. How it is solved? Explain bootstrapping principle and how effectively it is used in Darlington pair? 10

Q4. (a) Design class A transformer coupled power amplifier for the following specifications. Peak output voltage = 5V, Load Resistance = 4Ω, supply voltage of 20V with lower 3dB frequency of 15 Hz. 12

(b) Explain the principle of working of wein bridge oscillator circuit. Explain why negative feedback in addition to the usual positive feedback is employed in wein bridge oscillator. Find an expression for the frequency of oscillation and gain. 08

Q5. (a) What is a Heat Sink? Why is it required for power amplifiers? Show the relationship between thermal and electrical analogy with neat sketch. 08

(b) Explain the practical cascode amplifier and derive the expression for Av, Ri and Ro. List the applications of cascode amplifier. 12

Q6. (a) Explain why a voltage amplifier cannot be used as good power amplifier. 08

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

Q7. Write a short note on following: 20
(a) Crystal Oscillator and its application.
(b) Frequency response of R-C coupled of amplifier.
(c) Harmonic distortion in power amplifier.
(d) High frequency π model for common emitter transistor.

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_{CER} (Sus) volts d.c.	V_{CEX} volts d.c.	V_{EBO} volts d.c.	T_j max °C	D.C. current gain min	D.C. current gain typ.	D.C. current gain max.	Small-Signal h_{fe} min.	Small-Signal h_{fe} typ.	Small-Signal h_{fe} max.	V_{BE} max.	θ_{jc} °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 × 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
ECN 100	500 Ω	—	—	—
ECN 149	250 Ω	—	—	—
ECN 055	100 Ω	—	—	—
2N 3055	25 Ω	—	—	—

BFW 11—JFET MUTUAL CHARACTERISTICS

$-V_{GS}$ 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_{DS} 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_{DS} 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_{DS} 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_{DS} max. Volts	V_{DG} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{mo} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
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

17/12/2011 SE EXTC -Sem-IV (Rev) PCE

AGJ 2nd half (f+) 29

Con. 6636-11. **MP–4384**

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

N.B. : (1) Question No.**1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Make **suitable** assumptions wherever **necessary** and **clearly** justify them.

Q1.(a) Explain White Gaussian Noise and Determine thermal noise power at room temperature for a B.W. of 5MHz, Also calculate noise volt for R= 50Ω. 10

(b) Draw the block diagram of Superheterodyne Radio Receiver and explain Selectivity & Sensitivity of radio receiver, what is tracking error? 10

Q2.

(a) Distinguish between High level and low level modulation by six points. 06

(b) An AM transmitter radiates 5 MHz carrier with 80 kw power, carrier is modulated by 500 Hz & 1KHz signals. 08

1. What will be the total modulation index if each signal modulates at 60% of modulation?
2. Determine the transmitted power.
3. Draw the frequency spectrum of modulated signal.
4. What is % of power saving if one of sideband and carrier is suppressed?

(c) Explain VSB transmission & states its two advantages. 06

Q3.

(a) State necessity of pre emphasis & de-emphasis. Draw 75 usec circuit and explain them. 6

(b) Distinguish between –(i)Narrowband & wideband FM
(ii) FM & PM 8

(c) The modulating freq in FM system is 600Hz and the modulating voltage is 2V, with depth of modulation of 70. Calculate the maximum deviation. What will be the modulation index if the modulating frequency is reduced to 400Hz & modulating voltage is simultaneously raised to 3.5v? 6

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Q4.

(a) What is double spotting? How does it arise and how it can be reduce? 06

(b) A receiver is tuned to 3-30 MHz frequency range with IF frequency of 40.525 MHz. 08

(i) Find the range of local oscillator frequency and image frequency Of AM receiver having channel bandwidth of 10 KHz.

(ii) Draw the frequency response of IF & AF amplifiers.

(c) Compare delayed AGC & simple AGC. Explain working of delayed AGC circuit. 06

Q5.

(a) With block diagram, explain working of Radio detector, How amplitude limiting is achieved in it? Explain. 06

(b)(i) What is aliasing error? How it can be eliminated? 04

(ii)Find the Nyquist rate Nyquist interval for the signal $x(t) = \frac{\sin 200\pi t}{\pi t}$ 04

(c) State advantages and drawbacks of pulse modulation over continuous wave modulation. 06

Q6.

(a) With the help of block diagram, explain how AFC system stabilize the local oscillator frequency. 06

(b) Explain generation of Flat top sampling with neat circuit diagram. 06

(c) With neat block diagram and waveforms, explain working of Adaptive delta modulation. State its advantages. 08

Q7.Write short notes:(Any four) 20

(a) Non Uniform Quantizations

(b) μ-law & A-law of companding

(c) Generation of PWM & advantages of PWM

(d) Fidelity and image frequency of AM receiver

(e) Delta modulation

(f) Phase Modulation.

8/12/2011 SE EXTC IV
A & D IC D & A

Con. 6291-11. **MP-4387**

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

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **four** questions from remaining questions.
(3) Assume **suitable** data if **necessary**.
(4) In all **five** questions to be attempted.
(5) Draw **neat** circuit diagram wherever **necessary**.

1. (a) Explain current amplifier with grounded load. **5**
(b) Explain requirements of an instrumentation amplifier. **5**
(c) Explain Flas ADC. **5**
(d) Explain multiplier characteristics. **5**

2. (a) Draw the internal block diagram of IC XR 2206 and explain it. **10**
(b) Draw the circuit of basic integrator using op-amp. Find expression for output voltage. Explain disadvantage of basic integrator. **10**

3. (a) Design a multiple feedback low pass filter with $H_0 = 3$, $F_0 = 5$ KHz and $Q = 6$. **10**
(b) Explain internal block diagram of IC 555 with monostable mode. Explain one application of it. **10**

4. (a) Draw the circuit of instrumentation amplifier with dual op-amps. Find expression for the output voltage. **10**
(b) Design an astable using 555 with output frequency 1 KHz with 60% duty cycle. Modify the circuit design to obtain 1 KHz output frequency with 40% duty cycle. **10**

5. (a) Write the VHDL code for simple 4-bit counter with Rising Clock Edge and Asynchronous Active Low clear input. **10**
(b) Draw the block diagram of IC 565 and explain it. Also mention important electrical characteristics of 565. **10**

6. (a) For 5-bit R-2R ladder network with 0 = 0 V and 1 = 10 V. Find — **10**
(i) Analog output due to LSB change
(ii) Full scale output voltage
(iii) Analog output for digital input 11000.
(b) Design a sequential circuit using Mealy machine to detect an overlapping sequence as follows 1010. **10**

7. (a) Explain inverting Schmitt trigger. **5**
(b) Explain antilog amplifier. **5**
(c) Explain FPGA. **5**
(d) Differentiate between Moore and Melay circuit. **5**

Con. 6050–11. **MP–4382**

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

N. B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.

1. (a) Prove that – 5

$$\int J_3(x)\,dx = \frac{-2J_1(x)}{x} - J_2(x)$$

(b) If $w = z^2 + 2z$ prove that $|z| = 1$ corresponds to a cardioide in w-plane. 5

(c) Evaluate $\int_c \left(z^2 - 2\bar{z} + 1\right) dz$ where c is the circle $x^2 + y^2 = 2$. 5

(d) Evaluate $\iint_s \bar{F}\cdot\hat{n}\,ds$ where $\bar{F} = x^3 i + y^3 j + z^3 k$ and s is the surface of the sphere $x^2 + y^2 + z^2 = 16$. 5

2. (a) Verify Gauss Divergence theorem for $\bar{F} = 4xi - 2y^2 j + z^2 k$ taken over the region of the cylender bounded by $x^2 + y^2 = 4$ $z = 0$ and $z = 3$. 8

(b) Evaluate $\int_0^{2\pi} \frac{d\theta}{(2+\cos\theta)^2}$. 6

(c) Find $A^7 - 4A^6 - 20A^5 - 34A^4 - 4A^3 - 20A^2 - 33A + 2I$ 6

where $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$.

3. (a) Find Eigen values and Eigen vectors of $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ and verify that the Eigen value are of unit modulus. 8

(b) Evaluate $\iint_s \bar{A}\cdot\hat{n}\,ds$ where $\bar{A} = zi + nj - 3y^2 z k$ and s is the surface of the cylender $x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 5$. 6

(c) Prove that $\int_0^1 x\left(1-x^2\right) j_0(ax)\,dx = \frac{4}{a^3} J_1(a) - \frac{2}{a^2} J_0(a)$. 6

4\. (a) Prove that $x\left(4-x^2\right) = 8\sum_{i=0}^{\infty} \frac{J_3(2\lambda_i)}{\lambda_i^2 J_2^2(2\lambda_i)} J_1(\lambda_i x) \quad 0 \le x \le 2.$ **8**

Where λ_i (i = 0, 1, 2,...) are the roots of $J_n(2\lambda) = 0$.

(b) Find two distinct Laurent series for $f(z) = \frac{2z-3}{2^2-4z+3}$ in powers of (z − 4) indicating the R.O.C. **6**

(c) Show that $A = \begin{bmatrix} 1 & -6 & -4 \\ 0 & 4 & 2 \\ 0 & -6 & -3 \end{bmatrix}$ is similar to a diagonal matrix. Also find transforming matrix and diagonal matrix. **6**

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2/12/11 S.E (EXTC)
Applied Mathematics-IV

5. (a) Reduce the following Quadratic form into real Canonical form and hence find its rank, index, signature. Also determine the value class of Quadratic form. 8
$$Q = 6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4xz.$$
(b) Verify Laplace equation for $u = \left(r + \frac{a^2}{r}\right) \cos\theta$ also find v and f(z) where f(z) = u + iv is analytic function. 6
(c) Verify Green's theorem for $\overline{F} = \left(x^2 - y^2\right) i + (x+y) j$ along c where c is triangle having vertices (0, 0), (1, 1) and (2, 0). 6

6. (a) (i) Evaluate by using Residue theorem $\int_c \operatorname{sech} z \, dz$. where c is $|z| = 2$. 4
(ii) Prove that $4J_0'''(x) - 3J_1(x) + J_3(x) = 0$ 4
(b) Find bilinear transformation which maps the points z = 1, i, –1 onto the points w = i, 0, –i. Is the transformation parabolic ? 6
(c) Is $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$ derogatory ? Explain. 6

7. (a) (i) Evaluate $\int_c \frac{dz}{z^3(z+4)}$ where c is $|z| = 2$. 4
(ii) $A = \begin{bmatrix} 2 & 3 \\ -3 & -4 \end{bmatrix}$ find A^{50}. 4
(b) Apply Stoke's theorem to evaluate $\int_c (x+y)\,dx + (2x-z)\,dy + (y+z)\,dz$ 6
Where c is the boundary of the triangle with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6).
(c) Prove that analytic function with constant modulus is constant. 6