S.E. Sem IV (old) (EXTC)

AM-IV

23/11/15

QP Code : 1331

[OLD COURSE]

(3 Hours) [Total Marks:100]

N.B. (1) Question No. **1** is **compulsory.**

(2)Attempt **Any FOUR** questions out of the remaining **SIX questions.**

(3) Figures to the right indicate full marks.

1(a) Prove that eigen values of Hermitian matrix are real. **[5]**

(b) Construct an analytic function whose real part is $x^4 - 6x^2y^2 + y^4$ **[5]**

(c) A vector field is given by $\overline{F} = (x^2 + xy^2)\hat{i} + (y^2 + x^2y)\hat{j}$. Show that $\overline{F}$ is irrotational and find its scalar potential. **[5]**

(d) Prove that $J_{\frac{-1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\cos x$. **[5]**

2(a) Verify Green's theorem in plane for $\int (xy + y^2)dx + x^2dy$ where C is the close curve of the region bounded by $y = x$ and $y = x^2$. **[8]**

(b) If $A=\begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ then find A^{50} **[6]**

(c) Find the image of a circle |z|=2 under the transformation w= z+3+2i.Also draw the figure **[6]**

3(a) Show that the matrix $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix. **[8]**

(b) Evaluate $\int_A^B (y^2dx + xydy)$ along $x = t^2, y = 2t$ from (1,-2) to B(0,0) **[6]**

(c) Evaluate $\int \frac{3z^2 + z}{z^3 - 1}dz$ where C is circle |z|=2. **[6]**

4(a) Reduce the given quadratic form $2x^2 + y^2 - 3z^2 + 12xy - 4xz - 8yz$ to canonical form and find rank and signature. **[8]**

(b) Evaluate by Residue theorem,

$$\int_0^{2\pi} \frac{\cos 2\theta}{5 + 4\cos\theta}d\theta$$ **[6]**

(c) Prove that $J_{\frac{5}{2}}(x) = \sqrt{\frac{2}{\pi x}}\left\{\frac{3 - x^2}{x^2}\sin x - \frac{3}{x}\cos x\right\}$ **[6]**

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QP-Con. 8131-15.

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5(a) Expand $f(z)=\frac{1}{z(z+1)(z-2)}$ when i) $0<|z|<1$ ii) $1<|z|<2$ iii) $|z|>2$ [8]

(b) Using Cayley-Hamilton theorem find $A^6-6A^5+9A^4+4A^3-12A^2+2A-I$

where $A=\begin{bmatrix}3 & 10 & 5\\ -2 & -3 & -4\\ 3 & 5 & 7\end{bmatrix}$ [6]

(c)Find the bilinear transformation which maps the points z= 1,i,-1 on to the points i,0,-i in W plane [6]

6(a) By using Stoke's theorem evaluate $\int_C[(x^2+y^2)\hat{i}+(x^2-y^2)\hat{j}].d\bar{r}$ where C is the boundry of the region enclosed by circles $x^2+y^2=4,\ x^2+y^2=16.$ [6]

(b) Show that the matrix $A=\begin{bmatrix}2 & -2 & 3\\ 1 & 1 & 1\\ 1 & 3 & -1\end{bmatrix}$ is non derogatory. [6]

(c)Show that the following function

$$f(z)=\frac{x^2y^5(x+iy)}{x^4+y^{10}}\quad z\neq 0$$

$$=0 \qquad z=0$$

is not analytic at the origin although Cauchy Riemann equations are satisfied. [6]

7(a) Evaluate $\iint\bar{F}.\bar{ds}$ using Gauss Divergence theorem, where $\bar{F}=4x\hat{i}-2y^2\hat{j}+z^2\hat{k}$ and S is the region bounded by $y^2=4x, x=1, z=0, z=3$ [8]

(b) Show that the map of real axis of the Z plane is a circle under the transformation ,, $w=\frac{2}{z+i}$ Find its center and radius. [6]

(c)Expand $f(x)=1$ in $(0<x<1)$ in a series as $1=\sum\frac{2}{\lambda_n J_1(\lambda_n)}J_0(\lambda n(x))$ where $\lambda_1,\ldots\lambda_n\ldots$ are positive roots of $J_0(x)=0$ [6]

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S. E. IV (Old)
EXTC

QP Code : 1377

Time:- 3 hrs. Maximum Marks:- 100

N. B.

1. *Question no. 1 is compulsory.*
2. *Answer ant four out of the remaining six questions.*
3. *Assumption made should be clearly stated.*
4. *Assume any suitable data wherever required but justify the same.*
5. *Figures to the right indicate marks.*
6. *Illustrate the answers with sketches wherever required.*
7. *Answer to the questions should be grouped and written together*
8. *Use Blue/Black ball ink pen to write answers. Use of pencil should be done only to draw sketches and graphs*

Q.1. a Explain logarithmic amplifier and derive the expression for the output voltage. 5

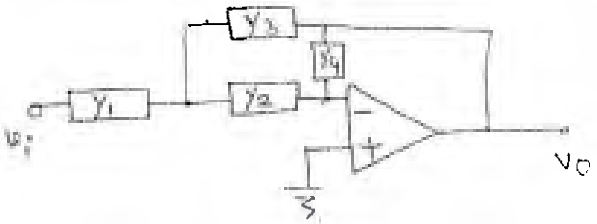
b. Draw the block diagram of a typical Op-amp and explain the function of each block 5

c. With neat circuit explain how a resistor can be simulated using switch capacitors 5

d. What are the differences between FPGAs and CPLDs. 5

Q.2. a Explain the basic requirement of Instrumentation Amplifier and find output voltage expression for Instrumentation Amplifier using three Op-Amp. 10

b. Derive an expression for the voltage transfer function. How will you realize an active RC Band Pass filter using this circuit. 10



Q.3. a Design an astable multivibrator using IC 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

b. With the help of block diagram explain the working of IC565. Explain the following terms with respect to a PLL : 10

1. Lock Range 2. Capture range 3. Pull in time

Q.4.a Explain the operation of monostable multivibrator using IC555 with the help of waveforms. How can this circuit be used as frequency divider. 10

b. Write a VHDL code for 8-bit shift-left / shift-right register with positive edge clock, serial in and parallel out. 10

Q.5.a. Give three most important advantages of 3-op-amp Instrumentation amplifier. Design an instrumentation amplifier using 3-op-amp to vary the gain between 1 to 100. 10

b. What are the performance parameters of DAC. Explain R-2R ladder type of DAC. 10

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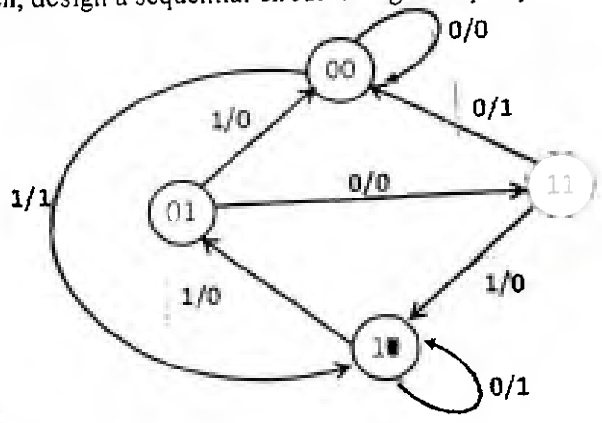
Q.6.a. Design a Moore machine for overlap sequence detector for the string" 1011". 10

b. For the state diagram given, design a sequential circuit using D Flipflops 10



Q.7. Write short notes on: 20

a IC 8038 : Function Generator
b Non Inverting Schmitt Trigger
c Compare Static and Dynamic RAM
d Multiplier using transconductance method

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SE. EXTC sem IV (old) / EDC-IV

04/12/15

QP Code : **1421**

(3 Hours) [Total Marks :100

N.B. : (1) Question no. 1 is **compulsory.**
(2) Attempt any **three** questions out of remaining questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume suitable **data** if required.

1. Design two stage R-C coupled CE amplifier for the following specifications: 20
$AV \geq 1600$ $V0 = 3.2V$.
Determine voltage gain input impedance and total current supplied by source Vcc.

2. Design two stage RC coupled amplifier for the following parameters AV ≥ 75 , 20
frequency = 20Hz V_0 = 3 volts, I_{0a} = 1.38 mA, Ri = 1mΩ used Bf w11 JFET

3. (a) Design large signal transformer coupled class A power amplifier to provide 6W 10
output power to the 4Ω load.
(b) For dual input balanced output differential amplifier analyze and derive the expression 10
for (i) Differential mode gain (Ad) (ii) Common mode gain (Ac) (iii) CMRR

4. (a) Explain the working principle of a Wein Bridge oscillator. Derive the expression 10
for the frequency of oscillation.
(b) Write short notes on (i) Colpitts Oscillator (ii) Clapp Oscillator 10

5. (a) Design a RC phase shift oscillator using JEET for frequency of oscillation of 1 kHz 10
(b) Explain why a voltage amplifier cannot be used as a good power amplifier 10

6. (a) Discuss Darlington pair. What are its primary features? Obtain Expression for 10
Av, Ai and Ri
(b) Explain the practical cascode amplifier and derive the expression for Av, Ri and 10
Ro

7. Write short note on following: 20
(a) Negative feedback topologies
(b) Class 'C' power amplifier
(c) Frequency Response of RC coupled amplifier
(d) Hartely oscillator

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QP Con. 9883-15.

S.E. EXTC (IV) (old) 10/12/15

PCE

QP Code : 1466

(3 Hours) [Total Marks : 100

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

1. Answer the following (any **four**) 20
   (a) Explain the function of Amplitude limiter in F.M. receiver
   (b) Explain the term companding with respect to PCM.
   (c) How power saving and Bandwidth saving is achieved in SSB-SC system.
   (d) Explain what double spotting is and how it arises?
   (e) Discuss the advantages of Digital communication over analog communication.

2. (a) Explain in brief the operation of Balanced ring modulator 10
   (b) An A.F. Signal 20 sin ($2\pi \times 500t$) is used to amplitude modulate a carrier of 10
   $50 \sin (2\pi \times 10^5 t)$
   Calculate :-
   (i) Modulation index
   (ii) Sideband frequencies
   (iii) Amplitude of each sideband
   (iv) Bandwidth required

3. (a) Explain the basic principle of FM demodulator with the help of neat block and phasor diagram explain the same in a foster seely discriminator. 10
   (b) How do you generate and modulate PAM signal? Is it an analog or digital signal? 10

4. (a) Draw and explain a block diagram of superheterodyne radio receiver, with waveforms at output of each block. 10
   (b) What are the advantages of superheterodyne receiver over the TRF receiver? Explain the terms tracking and image rejection. 10

5. (a) Discuss the slope over load and Granular noise error in Delta modulation. How it can be compensated in Adaptive delta modulation. 10
   (b) Draw the block diagram of a phase cancellation SSB generator and explain how the carrier and unwanted side bands are suppressed. 10

6. (a) Explain the difference between :- 10
   (i) Amplitude Modulation and Frequency Modulation
   (ii) Narrow band F.M. and wideband F.M.

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(b) Sketch the circuit diagram of a practical diode detector and explain the operation of it. How is AGC obtained from this detector. 10

7. Write short notes (any four) 20
   (a) Pre-emphasis and De-emphasis
   (b) ISB Transmitter
   (c) Sampling Theorem
   (d) TRF receiver
   (e) Quantization and Quantization error

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SE-(SEM IV) (Rev. 2007)-EXTC (old) Dec 2015

EMW

QP Code : **1512**

(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 and justify the same.

1. Attempt any **four** :–
   (a) State and explain vector form of coulomb's law.
   (b) Explain the method of Images.
   (c) State and prove Gauss's law for electrostatics.
   (d) Explain what is depth of penetration (skin depth). Find the skin depth at 1.6 MHz in Aluminium given $\sigma = 38.2$ M s/m and $\mu_r = 1.0$.
   (e) Explain polarization of electromagnetic waves.

2. (a) Derive the expression for Electric Field intensity due to an infinite surface charge. 10
   (b) In the region of free space that includes the volume 10
   $2 \le (x,y,z) \le 3$; $\bar{D} = \frac{2}{z^2}(yz\bar{a}x + xz\bar{a}y - xy\bar{a}z)$
   verify the divergence theorem for $\bar{D}$

3. (a) In the space, a line charge density 80 nC/m lies along the entire Z-axis, while point charges of 100 nC each are located at (1, 0, 0) and (0, 1, 0). Find the potential difference V_{PQ} given P(2, 1, 0) and Q(3, 2, 5) 10
   (b) Derive Laplace's and Poisson's equation. 10

4. (a) Derive an expression for magnetic field intensity due to an infinite current carrying conductor along Z-axis. 10
   (b) State Farady's law. Give expressions for emf when there is : 10
   (i) Stationery loop in time varying $\bar{B}$-field
   (ii) Moving loop in static $\bar{B}$ field

5. (a) Explain Maxwell's equations in differential and integral form for time varying fields. 10
   (b) $\bar{H} = Hx(wt - \beta z)\bar{a}x$ exists within a dielectric of permittivity ε 10
   Estimate the corresponding displacement current density and then find the charge density and electric field corresponding to H-field.

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QP-Con. 11615-15.

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6. (a) State and derive expression for Poynting theorem. Explain each term's meaning and significance. **10**

   (b) Given $\overline{H} = 6r \sin \phi \, a_r + 18 \, r \sin \theta \cos \phi \, a_\phi$; in sphenical system; evaluate stoke's theorem for the portion of the sphere $r = 4$, $0 \leq \theta \leq 0.1 \, \pi$ and $0 \leq \phi \leq 0.3 \, \pi$ **10**

7. (a) Explain the concept of scalar and vector magnetic potential. **10**

   (b) Derive electromagnetic wave equation for free space. **10**

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