sem-IV/old
EXTC/Applied math IV

13/05/16

QP Code :544700

[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 $\overline{F} = (y\sin z - \sin x)\hat{i} + (x\sin z + 2yz)\hat{j} + (xy\cos z + y^2)\hat{k}$.

Show that $\overline{F}$ is irrotational and hence 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 $\int (xy + y^2)dx + x^2 dy$ where C is the

close curve of the region bounded by $y = x$ and $y = x^2$ **[8]**

(b) If A=$\begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$ then prove that 3 tanA=A tan3 **[6]**

(c) Find the image of the region bounded by x=0,x=2,y=0,y=2 in the Z plane under

the transformation w=(1+i)z **[6]**

3(a) Show that the matrix A=$\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ is diagonalizable . Find the

transforming matrix and the diagonal matrix. **[8]**

(b) Evaluate $\int \bar{z}dz$ along $x = t^2, y = t$ from O(0,0) to B(4,2) **[6]**

(c) Evaluate $\int_C \frac{e^{2z}}{(z-1)(z-2)}dz$ where C is circle |z|=3. **[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 ,

$$\int_0^{2\pi} \frac{\cos 3\theta}{5 + 4\cos\theta} d\theta$$ **[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]**

[TURN OVER]

5(a) Expand f(z)= $\frac{1}{z^2(z-1)(z+2)}$ about z=0 when i) $|z|<1$ 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 from the Z plane on to the points $0,1,\infty$ 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 $x^2+y^2=4$, $x^2+y^2=16$. **[8]**

(b) Show that the matrix A=$\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 4\\ 3 & 4 & 5\end{bmatrix}$ 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 $\iint \bar{F}.\overline{ds}$ 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) Find the image of a circle |z|=2 under the transformation w= z+3+2i.Also draw the figure **[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]**

SE. SEM IV (R-2007) - EXTC (OLD) 06-June 2018

E. M. W. T.

Q.P. Code : 545101

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **four** questions out of the remaining **six** questions.
(3) Assume suitable **data** wherever **necessary**.
(4) Support your **answers** with neat **sketches** wherever **necessary**.

1. Answer any **four**. **20**
   (a) Derive boundry conditions for electrostatics.
   (b) Explain the concept of scalar and vector potential.
   (c) Derive Laplace and Poisson's equations.
   (d) State and explain Faraday's law.
   (e) Explain skin depth. Find skin depth at frequency 1.6MHZ in Aluminium whose α = 38.2 Ms/m and μr = 1.0

2. (a) Derive the equation for field intensity due to infinite current carrying conductor. **10**
   (b) Evaluate both sides of divergence theorem for the filed $D = 2xy\bar{a}x + x^2\bar{a}y\ c/m^2$ **10**
   and the rectangular parallel piped formed by planes x = 0 , x = 1, y = 0, y = 2, z = 0 and z = 3.

3. (a) In the space , a line charge density 80 nc/m lies along the entire Z axis, while **10**
   point charges of 100 nc each are located at (1,0,0) and (0,1,0). Find potential difference V_{PQ} given P (2, 1,0) and Q (3, 2, 5).
   (b) It is required to hold 3 equal point charges of +Q each in equilibrium at the **10**
   corner of an equilateral triangle. Calculate the point charge which will do this if placed at the centre of a triangle.

10

4. (a) Derive an expression for magnetic field intensity due to finite long straight element.
   (b) Use Laplace's equation to find capacitance per unit length of a coaxial cable of inner radius 'a' and outer radius 'b'. Assume V = Vo at r = a and v = 0 at r = b .

10

5. (a) State and derive experession for Poynting theorem. Explain each term in it. **10**
   (b) $\overline{H} = Hx(\omega t - \beta z)\,\bar{a}x$ exist within a dielectric of permitivitty ε . Estimate the corresponding displacement current density and then find charge density and Electric field corresponding to H field.

10

6. (a) Derive electromagnetic wave equation for free space. **10**
   (b) Given $H = 6r\sin\phi\,\bar{a}\,r + 18r\sin\theta\cos\theta\,\bar{a}\phi$ Evaluate Stokes theorem of the sphere for the portion of the sphere with r = 4, $0 \le \phi \le 0.1\pi$, $0 \le \phi \le 0.3\pi$

10

7. (a) Explain Maxwell's equation in differential and integral form for time-varying field. **10**
   (b) The circular loop conduction lies in z = 0 plane, has a radius of 0.1m and resistance of 5 ohm. Given B= 0.20 sin 10^3t $a\bar{z}$ (T). Determine the current in the loop.

SE - Sem - IV (Old) - EXTC 31/05/16

Principles of Communication Engg.

QP Code : 545001

(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**)
   (a) Explain what double spotting is and how it arises? **5**
   (b) Why VSB transmission is better for TV transmission. **5**
   (c) Compare the Narrow band FM with wideband FM. **5**
   (d) State sampling theorem. Discuss its importance in communication. **5**
   (e) Why is the over modulation in AM System undesirable? **5**

2. (a) Draw the block diagram of a phase cancellation SSB generator and explain how the carrier and unwanted sidebands are suppressed. **10**
   (b) An A.F. signal 20 sin (2π x500 t) is used to amplitude modulate a carrier of 50 sin (2π x10^5t). **10**
   Calculate :-
      (i) Modulation index
      (ii) Sideband frequencies
      (iii) Amplitude of each sideband **10**
      (iv) Bandwidth required **10**

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.
   (b) What is pulse-width modulation? How is it generated and demodulated? Sketch block diagram and explain with waveform. **10**
   10

4. (a) (i) Derive the terms sensitivity, selectivity and Image frequency.
      (ii) What are the advantages that the superheterodyne receiver has over the TRF receiver?
   (b) Sketch block diagram of Delta modulation transmitter. Explain the following with appropriate wave forms-
      (i) Slope overload error **10**
      (ii) Hunting error **10**

5. (a) What are the different methods of FM generation. Explain the Indirect Method (Armstrong Method) of F.M. generation. **10**
   (b) Draw the block diagram of a PCM System and explain the function of each block. What makes it a digital system.

[TURN OVER]

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

   (b) Explain what is meant by negative clipping and diagonal clipping? What are the conditions required to avoid each of them? **10**

7. Write Short note on (any **four**) **20**

   (i) Pre-emphasis and De-emphasis
   (ii) Companding with respect to PCM
   (iii) Quantization
   (iv) SSB modulation
   (v) TRF receiver

SE - SEM-IV EXTC (OLD) 25/5/16

Electronic Devices & Circuits - II

Q.P. Code : 544902

(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**.

1. (a) Design a two stage R-C coupled BC547 amplifier for the following parameters: $Av \geq 900$, $VO = 3V$ $F_L \leq 15Hz$. **15**
   (b) For the above designed amplifier determine Vo (max), Vi (min) and Rin **5**

2. (a) Design large signal class A transformer coupled power amplifier to provide 8W to 5 Ω load **15**
   (b) For designed circuit find efficiency at full load. **5**

3. (a) For the feedback amplifier shown in figure identify type of feedback and calculate Avf, Rif and Rof. hfe = 60, hie= 1.2KΩ, hre = hoe = 0. (V_{CC} = 12V, Rc = 3 KΩ, Rf = 50 KΩ) **12**

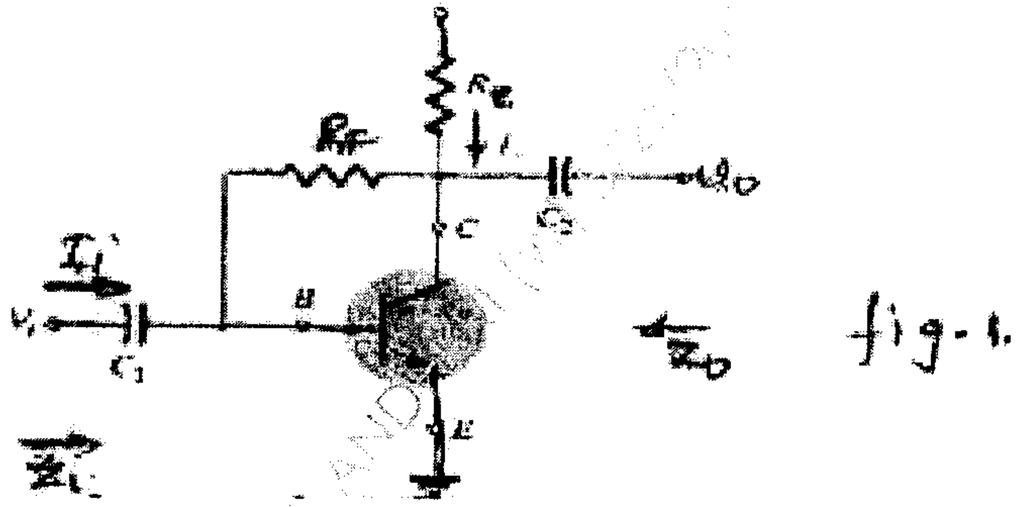

fig-1.

   (b) Explain working of transistorised Schmitt trigger circuit with appropriate waveforms. **8**

4. (a) Derive the expression for frequency of oscillation and gain of Wein Bridge oscillator. **10**
   (b) Design RC phase shift oscillator using JFET BFW 11 for frequency of oscillation 2 KHz. **10**

5. (a) Explain with block diagram different topologies of negative Feedback amplifier. **10**

[TURN OVER

(b) For the circuit shown in figure 2 (V_{BE} = 0.7 V, βac =βdc = 100, Vcc=12V, V_{EE}= -12V, R_E= 10KΩ Rs=100Ω and R'$_E$=100Ω **10**
Calculate i) Q point ii) Ad iii) Ac iv) CMRR

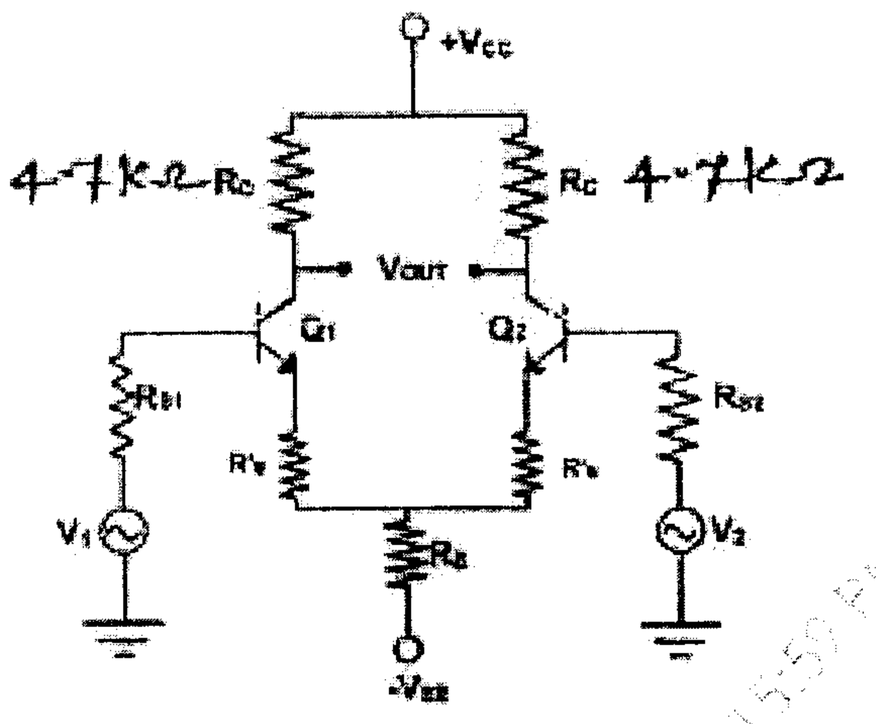

fig-2

6. (a) Explain practical cascode amplifier and derive the expression for Av, Ri and Ro **12**
(b) Explain why a voltage amplifier can not be used as good power Amplifier. **8**

7. Write a short note on following. (**any four**) **20**
(a) Voltage series feedback
(b) Distortion in power amplifier
(c) Darlington connection
(d) Design of Heat Sink
(e) Barkhausen's Criteria for oscillation

Transistor type	Pdmax @ 25°C Watts	icmax @ 25°C Amps	$V_{CE}^{(sat)}$ volts d.c.	V_{CEO} volts d.c.	V_{CEO} (Sus) volts d.c.	V_{CEX} (Sus) volts d.c.	V_{CBX} 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	0·05	
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

–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
Ios 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
Ios typ. mA	7·0	5·0	5·4	4·6	4·0	3·3	2·7	1·7	0·8	0·2	0·0	0·0	0·0	0·0
Ios min. mA	4·0	2·0	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_{DG} max. Volts	V_{GS} 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

S-E. EXTC Sem IV Old

19-5-16

Sub. - Analog & Digital IC Design & Appln.

QP Code : 28881

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

N. B. : (1) Question No.1 is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) **Figure** to **right** indicate **full** marks.
(4) Assume **suitable** data whenever **required**.

1. (a) Explain inverting Schmitt trigger. **5**
   (b) Explain antilog amplifier. **5**
   (c) Explain FPGA. **5**
   (d) Differentiate between Moore and Melay circuit. **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) What is Instrumentation amplifier,explain it with three opamp, and write down advantages and disadvantages of it. **10**
   (b) Explain opamp as voltage to current converter and mention the application of V-1 converter. **10**

4. (a) ExplainMonostablemultivibrator using IC 555 with the internal circuit diagram of IC 555, draw the wave form. Calculate the value of R and C for pulse width of 20 ms. **10**
   (b) What are the performance parameters of DAC. Explain anyone technique of DAC. **10**

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

6. (a) Obtain the transfer function for KRC low pass filter and draw the circuit. Calculate the component value if fo = 2 kHz. and Q = 4. **10**
   (b) Explain VCO IC 566 and its features. **10**

7. Write short notes on (any **three**) :– **20**
   (a) Explain current amplifier with grounded load.
   (b)Explain the followingterm in relation to PLL:
   (i) Lock range (ii) Capture range
   (c)Compare active filter and passive filter.

GE-Con. 10750-16.