S.E.EXTC sem IV (old). 21/11/14
AM-IV

(OLD COURSE) **QP Code :14315**

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

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

1. (a) Find the total work done in moving a particle in the force field. 5
$\bar{F} = 3xyi - 5zj + 10xk$ along $x = t^2+1$, $y=2t^2$, $z = t^3$ from $t = 1$ and $t = 2$

(b) Find the image of $|z-1| = 1$ under the transformation $w = z^2$ 5

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

(d) Explain the classification of Quadratic form (class value) using sylvester law of Inertia. 5

2. (a) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ 6

(b) Prove that the function defined by $f(z) = \frac{x^3(1+i) - y^3(1-i)}{x^2+y^2}$ when $z \neq 0$
$= 0$ when $z = 0$
is (i) continuous (ii) Cauchy's Riemann equators are satisfied at the origin. 6

(c) Verify Greeen's Theorem in the plane for $\oint (x^2 - y)dx + (2y^2 + x)dy$ around the boundary of the region defined by $y = x^2$ and $y = 4$. 8

3. (a) Defind derogatory and Non-derogatory matrix and hence show that 6
$$A = \begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix}$$

(b) Evaluate by Cauchy's Integral Formula $\int_c \frac{(4z-1)dz}{z^3 - 3z - 4}$ where C is the ellipse 6
$x^2+4y^2 = 4$

(c) Verify Stoke's Theorem for $\bar{F} = yzi + zxj + xyk$ and C is the boundary of the circle $x^2+y^2+z^2=1$, $z = 0$ 8

4. (a) Verify Cayley Hamilton Theorem and find A^{-1} for $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ 6

(b) Find all possible laurent'z series expansion of the function 6

$$f(z) = \frac{z^2 - 1}{z^2 + 5z + 6} \text{ around } z = 0$$

(c) Verify Gauss Divergence Theorem for $\overline{F} = 4xi - 2y^2j + z^2k$ taken over the region bounded by $x^2+y^2=4$, $z=0$, $z=3$. 8

5. (a) Find bilinear transformation that maps 1, -i, 2 of z- plane on to o, 2, -i of w-plane. 6

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

(c) Prove that $4J_n''(x) = J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)$. Also prove that $J_0'(x) = -J_1(x)$ 8

6. (a) Show that u = Cos x coshy is a harmonic function. Find its harmonic conjugate and corresponding analytic funtion. 6

(b) Find the residues $f(z) = \frac{1-z}{1-\text{Cos}z}$ at its singularities using Laurent's series expansion. 6

(c) Reduce the following quadratic form $2x_1^2+x_2^2-3x_3^2-8x_2x_3+4x_3x_1+12x_1x_2$ to normal form through congruent transformations. Also find its rank, index, signature and value class. 8

7) (a) Prove that $J_5''(x) = \left[\frac{30}{x^2} - 1\right] J_5(x) - \frac{1}{x} J_4(x)$ 6

(b) Show that the matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonisable. Find the diagonal form D and the diagonalising matrix M. 6

(c) A vector field $\overline{F}$ is given by 8

$\overline{F} = (y \sin z - \sin x)i + (x \sin z + 2yz)j + (xy\cos z + y^2)k$ Prove that it is irrotational and hence find its scalar potential.

S.E. EXTC sem IV (old).

ADIC

27/11/14.

(OLD COURSE) **QP Code : 14354**

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assumptions 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 answer with **sketches** wherever **required**.
(7) Answers to questions should be **grouped** and written **together**.
(8) Use a **bluelblack pen** to write answers. Use of **pencil** should be done only to **draw sketches** and **graphs**.

1. (a) Explain current amplifier. 5
   (b) Explain the log Amplifier. 5
   (c) Compare static RAM and dynamic RAM. 5
   (d) Explain Switched capacitor filter. 5

2. (a) Explain basic requirement of Instrumentatio amplifier and find output voltage expression for Instrumentation Amplifier using three op-amp. 10
   (b) List ideal characteristicsn of amp. 5
   (c) Explain Difference Amplifier. 5

3. (a) Design second order KRC highpass filter with cut off frequency FO = IKHZ and Q = 5 and draw circuit diagram. 12
   (b) Explan filter approximations. 8

4. (a) Explain Sample and Hold circuit .Draw input and output waveform. 10
   (b) Draw the block diagram ofIC 565 PLL . Explain in detail FSK demodulation using PLL. 10

5. (a) Write the VHDL code for 8 bit shift right register. 10
   (b) Draw and explain block diagram of CPLD 10

6. (a) Design Astable Multivibrator using 555 with output frequency 10 KHZ and duty cycle 70%. 10
   (b) Explain inverting Schmitt trigger and find the expression for the hysteresis width for it also mention transfer characteristics. 10

7. Write short notes on :— 20
   (a) Function generator IC 8038
   (b) V to I convertor using grounded load
   (c) Comparator circuit.

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S.E. EXTC (Old) Sem IV. 3/12/14
EDC II

(OLD COURSE) **QP Code :14400**

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

N.B.: (1) Question No. **1** and **2** are **compulsory**.
(2) Attempt any **three** questions from remaining **five** questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume **suitable** data wherever **necessary**.

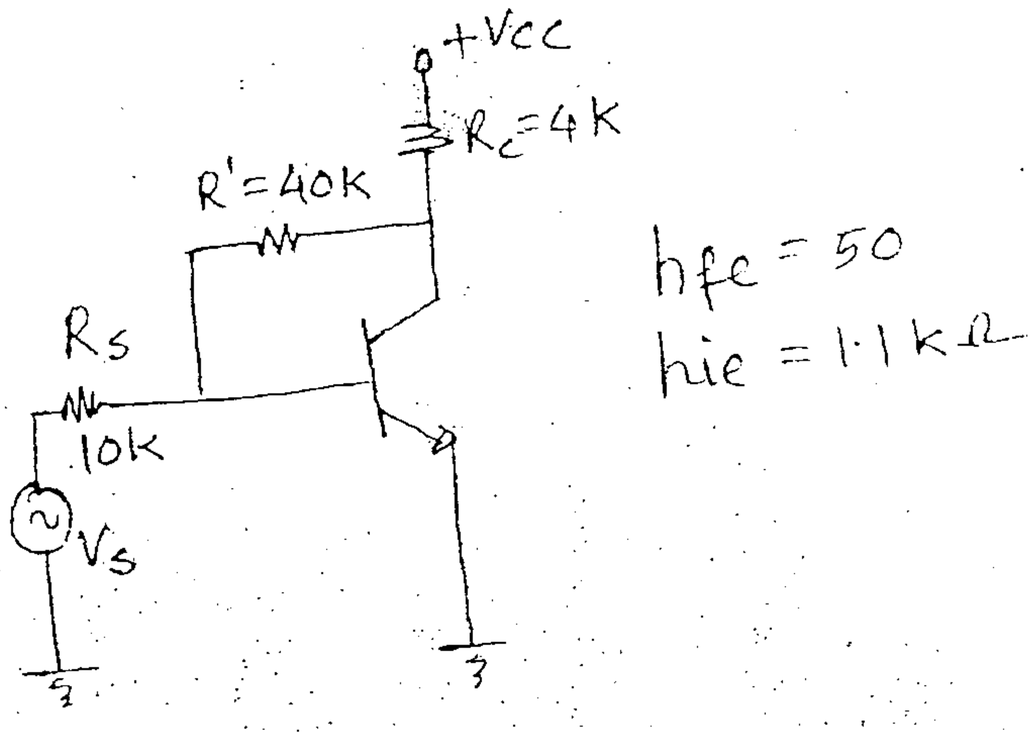
1. Design a two stage RC coupled CE-CE amplifier for the following parameters. **20**
Av $\geq$ 2500, Frequency $\leq$ 30Hz, stability factor $\leq$ 8, Vo = 2.5 volts.
Use BC 147 A transistor.

2. Design two stage RC coupled amplifier for the following parameters Av $\geq$ 75, **20**
frequency = 20Hz, Vo = 3 volts, I_{OQ} = 1·38 mA, Ri = 1 MΩ use BFWII JFET.

3. (a) Design large signal transformer coupled class A power amplifier to provide 6W **10**
output power to the 4Ω load.
(b) Draw two stage CE amplifier and derive the expression for **10**
(i) Small signal mid band vltage gain (ii) Input impedance
(iii) Output impedance.

4. (a) Explain the working principle of a wein bridge oscillator. Derive the expression for **10**
the frequency of oscillation and the value of gain required for sustained oscillation.
(b) Draw the circuit diagram for class B push-pull power amplifier and derive the **10**
expression for conversion efficiency.

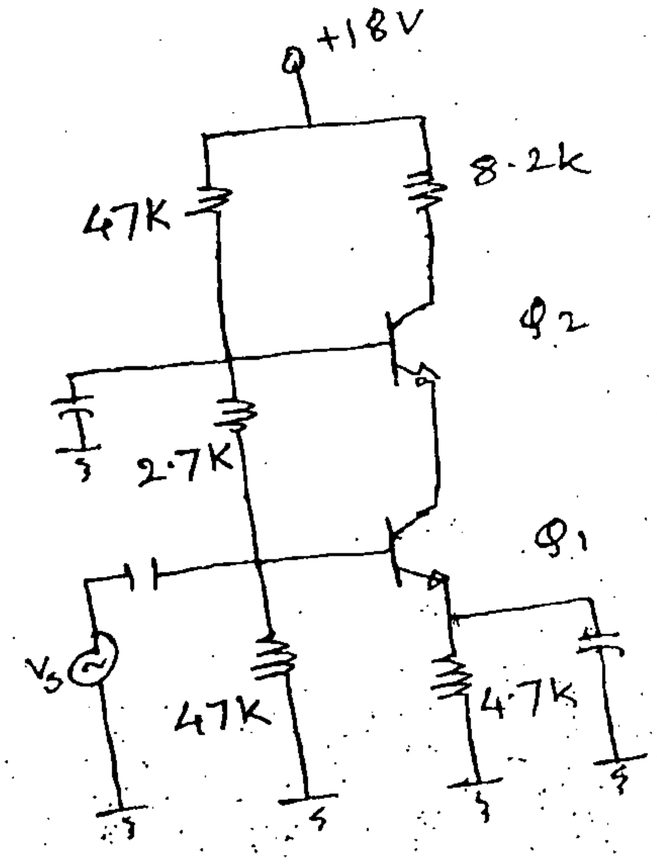
5. (a) Explain the operation of transistorized ASTABLE multivibrator with appropriate **10**
waveforms.
(b) For the feedback amplifier shown in figures, identify the type of feedback and find **10**
out Avf, Rif, Rof using -ve f/b approach.



[TURN OVER

6. (a) Draw the circuit diagram of dual input balanced output differential amplifier. Derive the expression for gain, input resistance and output resistance for dual input, balanced output differential amplifier. 10

(b) Determine Q point and voltage gain for given circuit. Derive expression for voltage gain for cascode amplifier. 10



7. Write a short note on following (any **four**) :– 20

(a) Colpitl's oscillator

(b) Compare small signal and large signal amplifier

(c) Hartely oscillator

(d) Negative feedback topologies

(e) Class C power amplifier.

Transistor type	P_{dmax} @ 25°C Watts	I_{cmax} @ 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.	Small Signal min.	Small Signal typ.	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	0.05
BC 147A	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	35	30	–	–	–	100	35	–	65	–	45	–	–	–	–
BC 147 B	0.25	0.1	0.25	50	45	50	–	6	125	200	290	450	240	330	500	0.9	–	–

Transistor type	h_{ie}	h_{oe}	h_{re}	α_{fe}
BC 147 A	2.7kΩ	18μmho	1.5×10^{-4}	0.4°C/mW
2N 525 (PNP)	1.4kΩ	25μmho	3.2×10^{-4}	—
BC 147B	4.5kΩ	30μmho	2×10^{-4}	0.4°C/mW
ECN 100	50Ω	–	—	—
ECN 149	15Ω	–	—	—
ECN 055	12Ω	–	—	—
2N 3055	6 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_{os} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ mho	8	50 KΩ	2 mW/°C	0.50°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ mho	2.5	50 KΩ	—	0.6[illegible]°C/mW

S E Extc (IV)(old)
pcom

(OLD COURSE) QP Code : **14439**

(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 necessary & state clearly.

1. Answer the following any **four** :– **20**
   (a) What is the purpose of AFC loop in FM?
   (b) Explain the use of limiter in FM receiver.
   (c) Define modulation & discuss its necessity.
   (d) Explain Noise Triangle in FM.
   (e) Explain quantization with the help of suitable diagram.

2. (a) List different methods of FM generation. Explain the principle of reactance modulator. Why is direct modulation not preferred for FM generation. **10**
   (b) Explain the following with reference to radio receivers. **10**
      (i) Image frequency
      (ii) Double conversion
      (iii) Tracking error
      (iv) Squelch circuit

3. (a) State advantages & disadvantages of SSB over DSB. Explain phase shift method to generate SSB. **10**
   (b) With the help of neat circuit diagram and phasor diagram explain the working of Foster-Seely discriminator. **10**

4. (a) What is balanced modulator? Sketch a balanced modulator circuit & explain its working. **10**
   (b) Compare :– **10**
      (i) AM & FM
      (ii) FM & PM.

5. (a) The output voltage of a transmitter is given by **10**
   $400 (1+0.4 \sin 6280 t) \sin 3.14 \times 10^7 t$. This voltage is fed to a load of 600 Ω resistance. Determine.
      (i) Carrier frequency
      (ii) Carrier Power
      (iii) Modulating frequency
      (iv) Total power output **10**
   (b) Draw the block diagram of pulse code modulation technique and explain each block.

[TURN OVER

6. (a) State and prove sampling theorem. **10**
   (b) Draw the block diagram of superhetrodyne receiver and describe the function of each block. **10**

7. Write short notes on any **four** :– **20**
   (a) Pre-emphasis and De-emphasis
   (b) ISB transmission
   (c) Adaptive Delta modulation
   (d) AGC
   (e) Companding.

SE-SEM IV (old) - EXTC

Dec 2014

E.M.T

QP Code : **17984**

(OLD COURSE)

[3 Hours] **[Total Marks:100**

N.B. (1) Question **No. 1** is compulsory and out of remaining questions attempt any **four**.
(2) Assume suitable **data** wherever necessary.

1.	(a)	State and explain the vector expression for Gauss's law for electrostatics.	**5**
	(b)	State and explain the vector expression for Bio- Savart's law. Explain how it is used to derive direction of magnetic field intensity.	**5**
	(c)	State and explain Faraday's law.	**5**
	(d)	Derive expression for potential at a distant point due to an electric dipole.	**5**
2.	(a)	Planes x = 2 and y = -3 respectively carry charges 10 nC/ m^2 and 15 nC/m^2. If line x=0, z= 2 carries charge 10π nC/m; Calculate $\overline{E}$ at (1, 1, -1) due to the three charge distributions.	**10**
	(b)	Derive expressions for energy stored in an electrostatic field of system of n point charges.	**10**
3.	(a)	Derive expressions for capacitance of a coaxial capacitor.	**8**
	(b)	Derive Laplace's and Poisson's equations. Explain how they are used to solve a boundary value problem with a suitable example.	**12**
4.	(a)	State Ampere's law. Find the field of an infinitely long current carrying conductor **using Amper's law**.	**10**
	(b)	Explain significance of Maxwell's equations for static fields. Give the modifications for time varying fields.	**10**
5.	(a)	Give plane wave equations for free space. What is the intrinsic impedance for free space?	**12**
	(b)	Explain what is displacement current. Give an example.	**8**
6.	(a)	Evaluate both sides of divergence theorem for $\overline{D} = \rho^2 \cos^2\phi\,\hat{\rho} + z\sin\phi\,\hat{\phi}$ (cylindrical coordinates) over the closed surface of a cylinder $0 \le z \le 1$, $\rho = 4$.	**8**
	(b)	State and explain Stoke's theorem. Determine curl of the vector field $\overline{P} = x^2yz\hat{x} + xz\hat{z}$ (Cartesian coordinates)	**20**
7.	Write short notes on any **two**:—		
	(a)	Boundary conditions for electrostatic fields	
	(b)	Magnetic scalar and vector potentials	
	(c)	Poynting theorem	
