MVJ COLLEGE OF ENGINEERING
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DEPARTMENT OF MEDICAL ELECTRONICS

COURSE DIARY

(ACADEMIC YEAR 2012-13)

III SEMESTER

Name : ____

USN : ____

The Mission

"The mission of our institutions is to provide world class education in our chosen fields and prepare people of character, caliber and vision to build the future world"

SCHEME OF TEACHING & EXAMINATION
B.E.MEDICAL ELECTRONICS
III SEMESTER (COMMON TO EC/TC/ML)

Subject Code	Title	Teaching Department	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 31	Engineering Mathematics - III	Mat	04		03	25	100	125
10ES – 32	Analog Electronic Circuits	@	04		03	25	100	125
10ES – 33	Logic Design	@	04		03	25	100	125
10ES – 34	Network Analysis	@	04		03	25	100	125
10IT– 35	Electronic Instrumentation	@	04		03	25	100	125
10ES – 36	Field Theory	@	04		03	25	100	125
10ESL – 37	Analog Electronics Lab	@		03	03	25	50	75
10ESL – 38	Logic Design Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

Academic Year 2012-13 ODD SEMESTER Time Table

DAY	1	2	3	4	5	6	7	8	9
TIMINGS	8.00-9.00	9.00-10.00	10.00-11.00	11.00-11.30	11.30-12.30	12.30-1.30	1.30-2.00	2.00-3.00	3.00-4.00
Monday				BREAK			LUNCH		
Tuesday									
Wednesday									
Thursday									
Friday									
Saturday									

SYLLABUS

Engineering Mathematics-III

Sub Code	**: 10MAT31**	IA Marks	:	25
Hrs/ Week	: 04	Exam Hours	:	03
Total Hrs.	: 52	Exam Marks	:	100

Academic Year 2012-13

PART – A

UNIT 1:
Fourier Series
Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

7 Hours

UNIT 2:
Fourier Transforms
Finite and Infinite Fourier transforms, Fourier sine and consine transforms, properties. Inverse transforms.

6 Hours

UNIT 3:
Partial Differential Equations (P.D.E)
Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type P p + Q q = R.

6 Hours

UNIT 4:
Applications of P.D.E
Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions. (Boundary value problems).

7 Hours

PART – B

UNIT 5:
Numerical Methods
Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordon methods. Gauss - Seidel iterative method. Definition of eigen values and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

6 Hours

UNIT 6:
Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse

interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule.
(All formulae / rules without proof)

7 Hours

UNIT 7:
Calculus of Variations
Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

6 Hours

UNIT 8:
Difference Equations and Z-transforms
Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations.

7 Hours

Text Book: Higher Engineering Mathematics by Dr. B.S. Grewal (36th Edition – Khanna Publishers)

Unit No	Chapter No	Article Numbers	Page Nos
I	10	10.1 to 10.7, 10.10 and 10.11	375 – 400
II	22	22.4, 22.5	716 – 722
III	17, 18	17.1 to 17.5, 18.2	541 – 547 562 – 564
IV	18	18.4, 18.5, 18.7	564 – 578 580 – 582
V	24	24.1, 24.2, 24.4 to 24.6, 24.8	820 – 826 829 – 840 843 – 845
VI	25	25.1, 25.5, 25.12 to 25.14, 25.16	846, 847 857 – 862 871 – 878 881 – 887
VII	30	30.1 to 30.5	1018 – 1025
VIII	26	26.1, 26.2, 26.9 to 26.15, 26.20, 26.21	888, 889 899 – 913

Reference Books:
1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

Note:
1. One question is to be set from each unit.
2. To answer <u>**Five**</u> questions choosing atleast <u>**Two**</u> questions from each part

LESSON – PLAN

SUB: - Engineering Mathematics-III

CODE-10MAT 31 (Common to all Branches)

TOTAL NO. OF CLASSES: 52 **HOURS/ WEEK: 04**

PERIOD NO	TOPIC TO BE COVERED (IN DETAIL)
	FOURIER SERIES
1	Periodic functions, Even and odd functions, properties.
2	Dirichlet's conditions, Fourier series over the $(0,2\pi)$ –examples.
3	Fourier series over the $(-\pi,\pi)$ –examples
4	Fourier series over the $(0,2l)\&(-l,l)$ –examples
5	Half Range Fourier Cosine series over the $(-\pi,\pi)$ –examples
6	Half Range Fourier Cosine series over the $(-l,l)$ –examples
7	Half Range Fourier Sine series over the $(-\pi,\pi)$ and $(-l,l)$ –examples
8	Complex Fourier Transforms
9	Practical Harmonic Analysis-Problems
	FOURIER TRANSFORMS
10	Finite Fourier Transforms-Examples
11	Infinite Fourier transforms – properties and examples
12	Fourier Sine transforms –examples
13	Fourier Cosine transforms –examples
14	Inverse Fourier Sine transforms –examples
15	Inverse Fourier Cosine transforms –examples
	PARTIAL DIFFERENTIAL EQUATIONS:
16	Formation of PDE by eliminating arbitrary Constants-examples
17	Formation of PDE by eliminating arbitrary Functions-examples
18	Solutions of non homogeneous PDE by direct integration-examples
19	Solutions of homogeneous PDE involving the derivatives
20	Method of separation of variables-examples
21	Solution of Lagrange's linear PDE of the type Pp+Qq=R -examples
	APPICATIONS OF PDE
22	Derivations of One-dimensional heat equation -examples
23	Derivations of One-dimensional wave equation -examples
24	Various possible solutions by method of separation of variables
25	D'Alemberts solution of wave equation
26	Two dimensional Lap lace's equation-examples
27	Various possible solutions
28	Solutions boundary value problems
	NUMERICAL METHODS
29	Numerical solutions of algebraic and transcendental equations
30	Newton-Raphson method – examples, Regula-Falsi method -examples
31	Solutions of linear simultaneous equations: Gauss elimination method
32	Gauss Jordon method, Gauss- Seidal iterative method
33	Definition of Eigen values and eigen vectors of square matrix –problems
34	Largest eigen value and eigen vector Rayleigh' power method
35	Finite differences interpolation : Forward & Backward interpolation-

	examples
36	Divided Differences- Newton's divided difference formula
37	Lagrange's Interpolation- examples , Lagrange's Inverse Interpolation-examples
38	Numerical Differentiation using Forward interpolation formula-examples
39	Numerical Differentiation using Backward interpolation formula- Examples
40	**Numerical Integration-Simpson's one third and three eighth rule-examples**
41	**Numerical Integration-Waddle's rule**
CALCULUS OF VARIATION	
42	Variation of function and functional ,Extremely of functional
43	Variational problems Euler's eqtn, Euler's equation - Problems
44	Standard variation problems including Geodesics
45	Minimal surface of revolution problems
46	**Hanging chain and Brachitochrone problem**
DIFFERENCE EQUATIONS AND Z TRANSFORMS	
47	Difference equations-Basic definitions
48	Z-transforms-Definition, standard Z-transforms
49	Linearity property, Damping rule
50	Shifting rule, Initial value and Final value theorem
51	Inverse Z-transforms
52	Application of Z- Transforms to solve differential equations.

VTU QUESTION PAPERS

USN | | | | | | | | | | | **06MAT31**

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08

Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions choosing at least TWO from each part.***

Part A

1 a. Find the Fourier series for the function $f(x)=x+x^2$ from $x=-\pi$ to $x=\pi$ and deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.........$ **(07 Marks)**

b. Obtain the cosine half-range Fourier series for $\begin{aligned} f(x)&=Kx, && \text{in } 0\le x\le l/2 \\ &=K(l-x) && \text{in } l/2\le x\le l \end{aligned}$. **(07 Marks)**

c. The following table gives the variating of periodic current over a period:

t (sec)	0	$T/6$	$T/3$	$T/2$	$2T/3$	$5T/6$	T
A (Amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic. **(06 Marks)**

2 a. Obtain the finite Fourier Cosine transform of the function $f(x)=e^{ax}$ in $(0, l)$. **(07 Marks)**

b. Find the Fourier sine and cosine transforms of $f(x)=\begin{cases} x, & 0<x<2 \\ 0, & \text{otherwise} \end{cases}$. **(07 Marks)**

c. Solve the integral equation, $\int_0^\infty f(x)\cos(\alpha x)dx=\begin{cases} 1-\alpha, & 0\le\alpha\le1 \\ 0, & \alpha>1 \end{cases}$.

Hence evaluate $\int_0^\infty \frac{1-\cos x}{x^2}dx$. **(06 Marks)**

3 a. Form the P.D.E by eliminating the arbitrary function from $z=y^2+2f\left(\frac{1}{x}+\log y\right)$. **(07 Marks)**

b. Solve $x^2\frac{\partial u}{\partial x}+y^2\frac{\partial u}{\partial y}=0$ by the method of separation of variables. **(07 Marks)**

c. Solve $(y^2+z^2)p+x(yq-z)=0$. **(06 Marks)**

4 a. Derive the one dimensional heat equation. **(07 Marks)**

b. Solve the wave equation $\frac{\partial^2 u}{\partial t^2}=C^2\frac{\partial^2 u}{\partial x^2}$ given $u(0,t)=0$; $u(l,t)=0$; $\frac{\partial u}{\partial t}=0$ when $t=0$ and $u(x,0)=u_0\sin\frac{\pi x}{l}$. **(07 Marks)**

c. Obtain the various possible solutions of the Laplacc's cquation $u_{xx}+u_{yy}=0$ by the method of separation of variables. **(06 Marks)**

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06MAT31

Part B

5 a. Find the real root of the equation $3x = \cos x + 1$ correct to four decimal places using Newton's method. (07 Marks)

b. Solve the system of equations,
$2x + y + z = 10$
$3x + 2y + 3z = 18$
$x + 4y + 9z = 16$
by Gauss-Jordan method. (07 Marks)

c. Find the largest eigen value and the corresponding eigen vector of the following matrix by using power method.

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

Taking $[1 \quad 0 \quad 0]^T$ as the initial eigen vector. Carry out four iterations. (06 Marks)

6 a. Given f(0) = 1, f(1) = 3, f(2) = 7, f(3) = 13. Find f(0.1) and f(2.9) using Newton Interpolation formula. (07 Marks)

b. Using Newton's divided difference formula evaluate f(8) and f(15), given that (07 Marks)

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

c. Evaluate $\int_4^{5.2} \log_e x dx$ by using Weddle's rule, taking 7 ordinates. (06 Marks)

7 a. Derive the Euler's equation in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. (07 Marks)

b. Find the extremal of the functional $\int_0^{\pi/2} \left[y^2 - (y')^2 - 2y\sin x\right]dx$ under the conditions $y(0) = y(\pi/2) = 0$. (07 Marks)

c. Find the geodesics on a surface, given that the arc length on the surface is $s = \int_{x_1}^{x_2} \sqrt{x\left[1 + (y')^2\right]}\,dx$. (06 Marks)

8 a. Find the z-transforms of i) $(n+1)^2$ ii) sin(3n+5). (07 Marks)

b. Obtain the inverse Z transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. (07 Marks)

c. Solve the difference equation,
$y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z transforms. (06 Marks)

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Third Semester B.E. Degree Examination, June-July 2009
Engineering Mathematics-III

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Obtain Fourier series for the function

$$f(x)=\begin{cases}\pi x & \text{for } 0\le x\le 1\\ \pi(2-x) & \text{for } 1\le x\le 2\end{cases}$$ and hence deduce that $\frac{\pi^2}{8}=\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$ **(07 Marks)**

b. Obtain the half range cosine series for the function $f(x) = \sin x$ in $0 \le x \le \pi$. **(07 Marks)**

c. Express y as a Fourier series up to first harmonics given

x :	0	60°	120°	180°	240°	300°	360°
y :	7.9	7.2	3.6	0.5	0.9	6.8	7.9

(06 Marks)

2 a. Find the Fourier transform of

$$f(x)=\begin{cases}1 & \text{for } |x|<1\\ 0 & \text{for } |x|>1\end{cases}$$ Hence evaluate $\int_0^{\infty}\frac{\sin x}{x}dx$ **(07 Marks)**

b. Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$ **(07 Marks)**

c. Solve the integral equation $\int_0^{\infty} f(\theta)\cos\alpha\theta\, d\theta = \begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}$ Hence evaluate $\int_0^{\infty}\frac{\sin^2 t}{t^2}dt$ **(06 Marks)**

3 a. Find the partial differential of all planes which are at constant distance from the origin. **(07 Marks)**

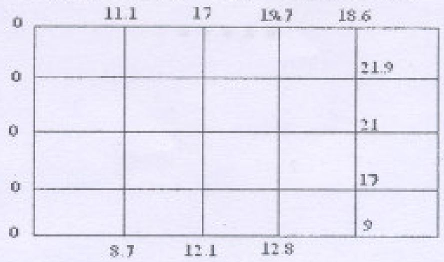
b. Using the method of separation of variables solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x, 0) = 6e^{-3x}$ **(07 Marks)**

c. Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ **(06 Marks)**

4 a. Derive one dimensional heat equation. **(07 Marks)**

b. Obtain D'Alembert's solution of wave equation $\frac{\partial^2 u}{\partial t^2} = c^2\frac{\partial^2 u}{\partial x^2}$ **(07 Marks)**

c. Solve the Laplace's equation $U_{xx} + U_{yy} = 0$ given that



(06 Marks)

06MAT31

PART – B

5 a. Using Newton-Raphson method find the real root of the equation $3x = \cos x + 1$ (07 Marks)

b. Solve the following system of equations using Gauss-Jordon method

$$x + y + z = 9$$
$$2x - 3y + 4z = 13$$
$$3x + 4y + 5z = 40$$

(07 Marks)

c. Find the largest eigen value and the corresponding eigen vector of the following matrix by using power method

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

Take $(1, 0, 0)^T$ as initial eigen vector. Carry out four iterations. (06 Marks)

6 a. A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time t sec. Find the velocity and its acceleration when $t = 0.3$ sec.

t	0	0.1	0.2	0.3	0.4	0.5
x	30.13	31.62	32.87	33.64	33.95	33.81

(07 Marks)

b. Given the values of x and y

x :	1.2	2.1	2.8	4.1	4.9	6.2
y :	4.2	6.8	9.8	13.4	15.5	19.6

Find the value of x corresponding to y = 12 using Lagrange's technique. (07 Marks)

c. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Weddle's rule taking 7 ordinates. (06 Marks)

7 a. Find the extremal of the functional $\int_0^1 \left[(y')^2 + 12xy\right] dx$ with $y(0)=0$ and $y(1) = 1$. (07 Marks)

b. Find the curve passing through the points $(x_1\ y_1)$ and $(x_2\ y_2)$ which when rotated about the x-axis gives a minimum surface area. (07 Marks)

c. Show that the geodesics on a plane are straight lines. (06 Marks)

8 a. Find the Z-transform of the following:

i) $(n + 1)^2$

ii) $5m\,(3n + 5)$

(07 Marks)

b. Find the inverse Z-transform of $\frac{z^3 - 20z}{(z-2)^3(z-4)}$ (07 Marks)

c. Solve the difference equation $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z-transforms. (06 Marks)

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Third Semester B.E. Degree Examination, Dec.09/Jan.10

Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Obtain Fourier series for the function f(x) given by

$$f(x) = \begin{cases} 1+\dfrac{2x}{\pi}, & -\pi \le x \le 0 \\ 1-\dfrac{2x}{\pi}, & 0 \le x \le \pi \end{cases}$$

and hence deduce that $\dfrac{\pi^2}{8} = \dfrac{1}{1^2} + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \ldots\ldots\ldots\ldots$ **(07 Marks)**

b. Find the half-range cosine series for the function $f(x) = (x-1)^2$ in the interval $0 < x < 1$. **(07 Marks)**

c. Obtain the constant term and the coefficients of the first sine and cosine terms in the Fourier expansion of y as given in the following table. **(06 Marks)**

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

2 a. Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| \le 0 \\ 0, & |x| > \pi \end{cases}$

Hence evaluate $\displaystyle\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cdot \cos\left(\frac{x}{2}\right) dx$ **(07 Marks)**

b. Find the Fourier cosine transform of e^{-x^2} **(07 Marks)**

c. Find the Fourier sine transform of $e^{-|x|}$. Hence show that $\displaystyle\int_0^\infty \frac{x\sin mx}{1+x^2} dx = \frac{\pi}{2} e^{-m}$, $m > 0$. **(06 Marks)**

3 a. Form the partial differential equation by eliminating the arbitrary functions f and g from the relation $z = y^2 + 2f\left(\dfrac{1}{x} + \log y\right)$ **(07 Marks)**

b. Solve $\dfrac{\partial^3 t}{\partial x^2 \partial y} + 18xy^2 + \sin(2x-y) = 0$ **(07 Marks)**

c. Solve $(mz - ny)\dfrac{\partial z}{\partial x} + (nx - lz)\dfrac{\partial z}{\partial y} = (ly - mx)$ **(06 Marks)**

4 a. Derive one dimensional heat equation by taking u(x, t) as the temperature, x is the distance and t is the time. (Write the figure also.) **(07 Marks)**

b. Obtain the D'Almbert's solution of the wave equation $u_{tt} = C^2 u_{xx}$, subject to the condition $u(x, o) = f(x)$ and $\dfrac{\partial u}{\partial t}(x, o) = o$. **(07 Marks)**

c. Obtain the various solutions of the Laplace's equation $u_{xx} + u_{yy} = 0$, by the method of separation of variables. **(06 Marks)**

06MAT31

PART – B

5 a. Complete the real root of the equation $x\log_{10}x - 1.2 = 0$ by Regula-Falsi method, correct to four decimal places. **(07 Marks)**

b. Solve the system of equations using Gauss-Jordan method:

$$2x + 5y + 7z = 52$$
$$2x + y - z = 0$$
$$x + y + z = 9$$

(07 Marks)

c. Using the power method, find the largest Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ **(06 Marks)**

6 a. The area of a circle (A) corresponding to diameter (D) is given below: **(07 Marks)**

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to diameter 105 using an appropriate interpolation formula.

b. Use Newton's divided difference formula to find f(9), given the data. **(07 Marks)**

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

c. Evaluate $\int_{4}^{5.2} \log_e x \, dx$ using Weddle's rule, taking 7 ordinates. **(06 Marks)**

7 a. Derive Euler's equation in the form

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$

(07 Marks)

b. Find the curves on which the functional $\int_0^1 \left[(y')^2 + 12xy\right] dx$, with $y(0) = 0$ and $y(1) = 1$ can be extremised. **(07 Marks)**

c. Find the geodesics on a surface given that the arc length on the surface is $S = \int_{x_1}^{x_2} \sqrt{x[1 + (y')^2]}\, dx$ **(06 Marks)**

8 a. Find the Z-transforms of the following :

i) $\cosh n\theta$ ii) $(n + 1)^2$ **(07 Marks)**

b. Find the inverse z-transform of $\frac{z}{(z-1)(z-2)}$. **(07 Marks)**

c. Find the response of the system $y_{n+2} - 5y_{n+1} + 6y_n = u_n$ with $y_0 = 0$, $y_1 = 1$ and $u_n = 1$ for n = 0, 1, 2, 3, ... by z-transform method. **(06 Marks)**

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MATDIP 301

Third Semester B.E. Degree Examination, Dec 08 / Jan 09

Advanced Mathematics - I

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. Define modulus and amplitude of a complex number x+iy and express $\frac{a+ib}{c+id}$ in x+iy form. **(06 Marks)**

b. Reduce $1-\cos\alpha + i\sin\alpha$ to the modulus amplitude form. **(07 Marks)**

c. If $\alpha + i\beta = \frac{1}{a+ib}$ then prove that $(\alpha^2+\beta^2)(a^2+b^2) = 1$ **(07 Marks)**

2 a. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$. **(06 Marks)**

b. Find the nth derivative of $e^{ax}.\cos(bx+c)$. **(07 Marks)**

c. If $y = e^{a\sin^{-1}x}$ prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$. **(07 Marks)**

3 a. If $u = x\log xy$ where $x^3+y^3+3xy=1$, find $\frac{du}{dx}$ as a total derivative. **(06 Marks)**

b. If u is a homogeneous function of degree 'n' in x and y, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = nu$. **(07 Marks)**

c. If $x = r\cos\theta$, $y = r\sin\theta$, then prove that $J.J' = 1$. **(07 Marks)**

4 a. Find the angle of intersection of curves $r = \sin\theta + \cos\theta$ and $r = 2\sin\theta$. **(06 Marks)**

b. Find the pedal equation of the curve $r^m = a^m.\sin m\theta$. **(07 Marks)**

c. Using Maclaurin's series, expand $e^{\sin x}$ upto the terms containing x^4. **(07 Marks)**

5 a. Obtain the reduction formula for $I_n = \int_0^{\pi/2} \cos^n\theta d\theta$, n being a positive integer and hence evaluate I_6. **(06 Marks)**

b. Evaluate $\int_0^5 \int_0^{x^2} x(x^2+y^2)dxdy$. **(07 Marks)**

c. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyzdxdydz$. **(07 Marks)**

6 a. Define Beta, Gamma functions and prove that $\Gamma(n+1) = n\Gamma(n)$. **(06 Marks)**

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MATDIP 301

b. Prove that $\beta(m, n) = \frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$ (07 Marks)

c. Express the intergral $\int_0^1 \frac{dx}{\sqrt{1-x^2}}$ in terms of Gamma functions. Prove that $\Gamma(n+1) = n!$, provided n is a positive integer. (07 Marks)

7 a. Solve $\frac{dy}{dx} = (4x + y + 1)^2$. (06 Marks)

b. Solve $(x^2-y^2)\,dx - xydy = 0$. (07 Marks)

c. Solve $\frac{dy}{dx} + \frac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$ (07 Marks)

8 a. Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = \sin 2x$. (06 Marks)

b. Solve $(D^2+2D+1)y = x^2$. (07 Marks)

c. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{2x}$. (07 Marks)

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ML (07) EC|TC|ML

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10MAT/PM/TL/MA31

Third Semester B.E. Degree Examination, December 2011
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. *Missing data will be suitably assumed.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Obtain the Fourier series for the function $f(x) = \begin{cases} \pi x & : 0 \le x \le 1 \\ \pi(2-x) & : 1 \le x \le 2 \end{cases}$ and deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$. (07 Marks)

b. Obtain the half range Fourier sine series for the function. (07 Marks)
$f(x) = \begin{cases} 1/4 - x \ ; \ 0 < x < 1/2 \\ x - 3/4 \ ; \ 1/2 < x < 1 \end{cases}$.

c. Compute the constant term and the first two harmonics in the Fourier series of $f(x)$ given by the following table. (06 Marks)

x :	0	1	2	3	4	5
f(x) :	4	8	15	7	6	2

2 a. Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| \le 1 \\ 0 & \text{for } |x| > 1 \end{cases}$ and hence evaluate $\int_0^{\infty} \left(\frac{x\cos x - \sin x}{x^3} \right) \cos \frac{x}{2} dx$. (07 Marks)

b. Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. (07 Marks)

c. Solve the integral equation $\int_0^{\infty} f(\theta)\cos\alpha\theta d\theta = \begin{cases} 1-\alpha \ ; & 0 \le \alpha \le 1 \\ 0 \ ; & \alpha > 1 \end{cases}$. Hence evaluate $\int_0^{\infty} \frac{\sin^2 t}{t^2} dt$. (06 Marks)

3 a. Solve two dimensional Laplace equation $u_{xx} + u_{yy} = 0$, by the method of separation of variables. (07 Marks)

b. Solve the one dimensional heat equation $\frac{\partial u}{\partial t} = \frac{c^2 \partial^2 u}{\partial x^2}$, $0 < x < \pi$ under the conditions :
i) $u(0,+) = 0, u(\pi, t) = 0$ ii) $u(x, 0) = u_0 \sin x$ where u_0 = constant ≠ 0. (07 Marks)

c. Obtain the D' Alembert's solution of one dimensional wave equation. (06 Marks)

4 a. Fit a curve of the form $y = ae^{bx}$ to the following data : (07 Marks)

x :	77	100	185	239	285
y :	2.4	3.4	7.0	11.1	19.6

b. Using graphical method solve the L.P.P minimize $z = 20x_1 + 10x_2$ subject to the constraints $x_1 + 2x_2 \le 40$; $3x_1 + x_2 \ge 0$; $4x_1 + 3x_2 \ge 60$; $x_1 \ge 0$; $x_2 \ge 0$. (06 Marks)

c. Solve the following L.P.P maximize $z = 2x_1 + 3x_2 + x_3$, subject to the constraints $x_1 + 2x_2 + 5x_3 \le 19$, $3x_1 + x_2 + 4x_3 \le 25$, $x_1 \ge 0$, $x_2 \ge 0$, $x_3 \ge 0$ using simplex method. (07 Marks)

1 of 2

10MAT/PM/TL/N

PART – B

5 a. Using the Regula – falsi method, find the root of the equation $xe^x = \cos x$ that lies be 0.4 and 0.6. Carry out four iterations. (07 I

b. Using relaxation method solve the equations :
$10x - 2y - 3z = 205$; $-2x + 10y - 2z = 154$; $-2x - y + 10z = 120$. (07 I

c. Using the Rayleigh's power method, find the dominant eigen value and the correspo eigen vector of the matrix. $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ starting with the initial vector $[1,1,1]^T$. (06 I

6 a. From the following table, estimate the number of students who have obtained the between 40 and 45 : (07 I

Marks	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
Number of students	31	42	51	35	31

b. Using Lagrange's formula, find the interpolating polynomial that approximate the fu described by the following table : (07 I

x	0	1	2	5
f(x)	2	3	12	147

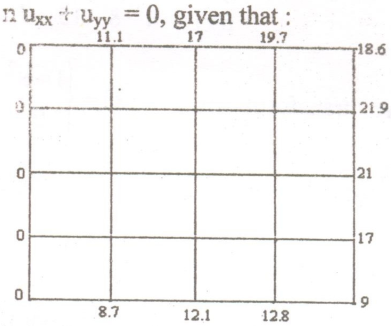
Hence find f(3)

c. A curve is drawn to pass through the points given by the following table :

x	1	1.5	2	2.5	3	3.5	4
y	2	2.4	2.7	2.8	3	2.6	2.1

Using Weddle's rule, estimate the area bounded by the curve, the x – axis and the $x = 1$, $x = 4$. (06 I

7 a. Solve the Laplace's equation $u_{xx} + u_{yy} = 0$, given that : (07 I



b. Solve $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = 0$; $u(4, t) = 0$; $u(x, 0) = x(4 - x)$. Take $h = 1$, k (07 M

c. Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = \sin \pi x$, $0 \le x$ $u(0\ t) = u(1, t) = 0$ using Schmidt's method. Carry out computations for two levels, t $h - 1/3$, $k = 1/36$. (06 M

8 a. Find the Z – transform of : i) $(2n-1)^2$ ii) $\cos\left(\frac{n\pi}{2} + \pi/4\right)$ (07 M

b. Obtain the inverse Z – transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$. (07 M

c. Solve the difference equation $y_{n+2} + 6y_{n+1} + 9y_n = 2n$ with $y_0 = y_1 = 0$ using Z transforms (06 M

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2 of 2

10ES32 – ANALOG ELECTRONIC CIRCUITS

SYLLABUS

Sub Code: 10ES32	I A Marks: 25
Hours / Week: 04	Exam Hours: 03
Total Hours: 52	Exam Marks: 100

Academic Year 2012-13

UNIT 1:
Diode Circuits: Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers.

UNIT 2:
Transistor Biasing: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased, DC bias with voltage feedback, Miscellaneous bias configurations, Design operations, Transistor switching networks, PNP transistors, Bias stabilization.

UNIT 3:
Transistor at Low Frequencies: BJT transistor modeling, CE Fixed bias configuration, Voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, Analysis of circuits re model; analysis of CE configuration using h- parameter model; Relationship between h-parameter model of CE,CC and CB configuration.

UNIT 4:
Transistor Frequency Response: General frequency considerations, low frequency response, Miller effect capacitance, High frequency response, multistage frequency effects.

UNIT 5:
(a) General Amplifiers: Cascade connections, Cascode connections, Darlington connections.
(b) Feedback Amplifier: Feedback concept, Feedback connections type,Practical feedback circuits. Design procedures for the feedback amplifiers**.**

UNIT 6:
Power Amplifiers: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Amplifier distortions. Designing of Power amplifiers

UNIT 7:
Oscillators: Oscillator operation, Phase shift Oscillator, Wienbridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only) Simple design methods of Oscillators.

UNIT 8:
FET Amplifiers:
FET small signal model, Biasing of FET, Common drain common gate configurations, MOSFETs, FET amplifier networks. (Chapter 8.1 to 8.13)

TEXT BOOK:
1. **Robert L. Boylestad and Louis Nashelsky**, "Electronic Devices and Circuit Theory", PHI. 9TH Edition.

REFERENCE BOOKS:
1. 'Integrated Electronics', Jacob Millman & Christos C. Halkias, Tata -McGraw Hill, 2nd Edition, 2010
2. "Electronic Devices and Circuits", David A. Bell, PHI, 4th Edition, 2004
3. "Analog Electronics Circuits: A Simplified Approach", U.B. Mahadevaswamy, Pearson/Saguine, 2007.

Lesson Plan

Subject: ANALOG ELECTRONIC CIRCUITS
Sub Code: 10ES32
Total No of Hours. : 52

Academic Year-2012-13

Hours	Topics to be covered
1.	**UNIT 1: Diode circuits** Diode Resistance, Diode equivalent circuits,
2.	Transition and diffusion capacitance
3.	Reverse recovery time, Load line analysis,
4.	Rectifiers
5.	Clippers and clampers.
6.	**UNIT 2: Transistor Biasing** Operating point, Fixed bias circuits
7.	Emitter stabilized biased circuits, Voltage divider biased
8.	DC bias with voltage feedback
9.	Miscellaneous bias configurations, Design operations
10.	Transistor switching networks
11.	PNP transistors, Bias stabilization.
12.	Bias stabilization.
13.	**UNIT 3: Transistor at Low Frequencies** BJT transistor modeling, Hybrid equivalent model
14.	CE Fixed bias configuration, Voltage divider bias
15.	Voltage divider bias
16.	Emitter follower
17.	CB configuration
18.	Collector feedback configuration
19.	Analysis of re model
20.	Analysis CE configuration using h-parameter model
21.	Relationship between h parameter model of CC,CE,and CB
22.	**UNIT 4: Transistor Frequency Response** General frequency considerations
23.	Low frequency response
24.	Miller effect capacitance
25.	High frequency response
26.	Multistage frequency effects.
27.	**UNIT 5 : (a)General Amplifiers & (b)Feedback Amplifier (a)**: Cascade connections
28.	Cascode connections
29.	Darlington connections
30.	**(b):** Feedback concept ,Feedback connections type.
31.	Practical feedback circuits
32.	Design procedure for the feedback amplifier
33.	**UNIT 6: Power Amplifiers** Definitions and amplifier types
34.	series fed class A amplifier
35.	Transformer coupled Class A amplifiers
36.	Class B amplifier operations
37.	Class B amplifier circuits
38.	Amplifier distortions
39.	Designing of power amplifier

40.	**UNIT 7: Oscillators** Oscillator operation
41.	Phase shift Oscillator
42.	Wienbridge Oscillator
43.	Tuned Oscillator circuits
44.	Crystal Oscillator
45.	Simple design methods of oscillators
46.	**UNIT 8: FET Amplifiers** FET small signal model
47.	Biasing of FET
48.	Common drain Configurations
49.	common gate Configurations
50.	MOSFETs
51.	FET amplifier networks.
52.	Tutorial

QUESTION BANK(ANALOG ELECTRONIC CIRCUIT-10ES32)

1.Explain the Diode equivalent circuits

2.Explain the Transition and diffusion capacitance

3.Explain the Rectifiers

4.Explain the Clippers and clampers

5.Explain the Operating point, fixed bias circuits

6.Explain the Emitter stabilized biased circuits

7.Explain the Voltage divider biased, DC bias with voltage feedback

8. Explain the PNP transistors

9.Explain the BJT transistor modeling, Hybrid equivalent mode

10.Explain the CE fixed bias configuration

11 .Explain the Miller effect capacitance

12.Explain the Multistage frequency effects

13.Explain the General amplifiers: Cascade connections

14. Explain the Cascade connections

15. Explain the Darlington connections

16. Explain the Series fed class A amplifier

17. Explain the Transformer coupled Class A amplifiers

18. Explain the Oscillator operation

19. Explain the Phase shift oscillator

20. Explain the Crystal oscillator

21.Explain the Biasing of FET

VTU QUESTION PAPERS

USN

06ES32

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Describe how diffusion and transition capacitances differ. **(05 Marks)**

b. A full wave bridge rectifier is supplied from the transformer secondary voltage of 100 V. Calculate the dc output voltage and peek inverse voltage of the diodes employed. **(05 Marks)**

c. For the clipper circuit shown in the Fig.1(c), the input is V_i = 50 Sin wt. Calculate and plot to scale the transfer characteristic, indicating slopes and intercepts. **(10 Marks)**

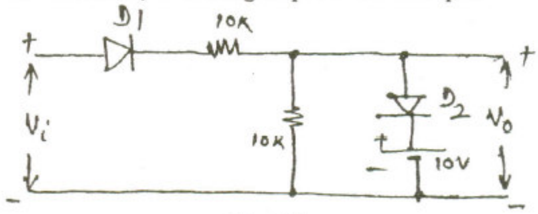


Fig.1(c).

2 a. Determine the voltage V_{eE} and I_c for the voltage divider configuration shown in Fig.2(a). **(10 Marks)**

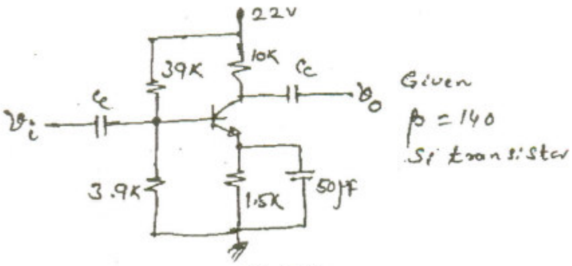


Fig.2(a).

b. Determine R_1 and R_c for the network of Fig.2(b). Given I_{CQ} = 2 mA, V_{CEQ} = 10 V. Assume S_i transistor. **(10 Marks)**

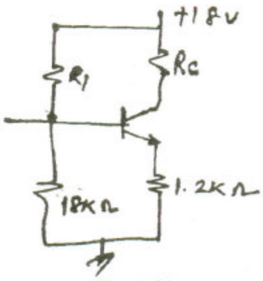


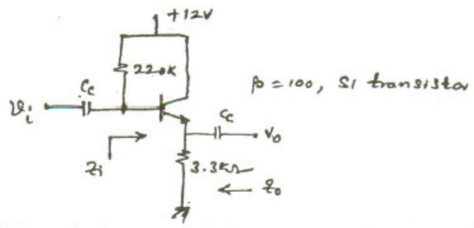
Fig. 2(b)

1 of 2

06ES3

3 a. For the emtter – follower network of Fig.3(a), using r_e model determine: i) r_e ; ii) z_i ; iii) z_o iv) A_V ; v) A_I. **(10 Marks)**

Fig.3(a).



b. Using complete hybrid equivalent model for a two part system derive expressions fo A_i, A_V, z_i and z_o. **(10 Marks)**

4 a. Prove that Miller effect capacitance $C_{Mi} = (1 - A_v)\, c_f$ and $C_{Mo} = \left(1 - \frac{1}{A_V}\right) c_f$. **(10 Marks)**

b. A four stage amplifier has a lower 3 db frequency for an individual stage of f_1 = 40 Hz and individual upper 3 db frequency of f_2 = 2.5 MHz. Calculate the overall lower 3 db and upper 3 db frequency of this full amplifier. Derive the expressions used. **(10 Marks)**

PART – B

5 a. Explain with the help of circuits what is cascade connection and cascode connection. What are the advantages of these connections? **(10 Marks)**

b. Explain the important advantages of a negative feedback amplifier. **(04 Marks)**

c. List the four types of feedback connections. Show one practical circuit for each feedback connection. **(06 Marks)**

6 a. Explain the working of a transformer coupled class B push pull amplifier. **(10 Marks)**

b. A Class B amplifier provides a 20 V peak signal to a 16 ohm load and a power supply of V_{cc} = 30 V. Determine the input power, output power and circuit efficiency. **(05 Marks)**

c. Calculate the harmonic distortion components for an output signal, having a fundamental amplitude of 2.5 V, second harmonic amplitude of 0.25 V, third harmonic amplitude of 0.1 V and fourth harmonic amplitude of 0.05 V. Also calculate the total harmonic distortion. **(05 Marks)**

7 a. Explain Barkhausen criterion for oscillations. **(05 Marks)**

b. With the help of a need circuit diagram, explain the working of Hartley oscillator. **(07 Marks)**

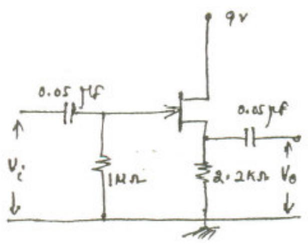
c. List the advantages of a crystal oscillator. Explain the working of a series resonant crystal oscillator. **(08 Marks)**

8 a. List three advantages of PET over BJT. **(03 Marks)**

b. With a neat circuit diagram, explain potential divider biasing of JFET. **(07 Marks)**

c. Calculate the voltage gain and input and output impedance for the circuit of Fig.8(c). **(10 Marks)**

Fig.8(c).



Given:
I_{DSS} = 16 mA
V_p = - 4V
r_d = 40 K Ω
V_{GSQ} = - 2.86 V.

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USN | | | | | | | | | | 06ES32

Third Semester B.E. Degree Examination, Dec.08/Jan.09
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions selecting at least 2 questions from each part.*
2. Draw equivalent circuit wherever necessary.

PART - A

1 a. Explain the different diode equivalent circuits with necessary approximations if any. **(06 Marks)**

b. Explain junction capacitance with reference to a PN – diode. **(06 Marks)**

c. Sketch the waveform of V_0 for the circuit below. **(08 Marks)**

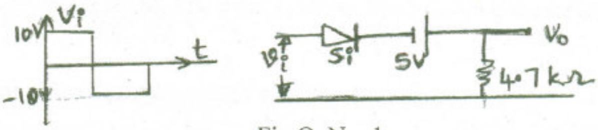

Fig Q. No. 1c.

2 a. Explain with help of load line the effect of variation of V_{CC}, I_B on Q-pt of a transistor. **(06 Marks)**

b. For the voltage Feedback network below determine I_C, V_{CE}, V_C, V_E. **(08 Marks)**

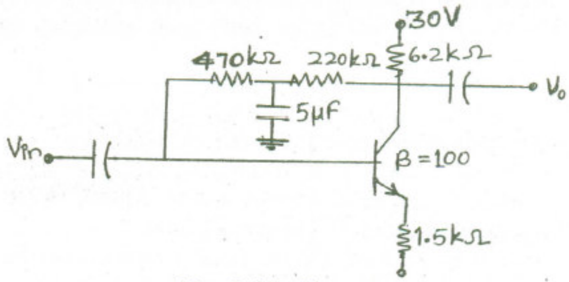

Fig. Q. No. 2b

c. Derive expression for S_{ICO} for a Voltage Divider bias circuit. **(06 Marks)**

3 a. Draw r_e and h – parameter models of a transistor in CE – mode. Give relation between r_e parameters and h – parameters. **(05 Marks)**

b. A voltage divider biased amplifier has V_{CC} = 20V, R_1 = 220kΩ, R_2 = 56kΩ, R_C = 6.8kΩ, R_E = 2.2kΩ. The Silicon transistor used has β = 180 and r_o = 70kΩ.
Find: i) ac emitter diode resistance, re.
ii) Input impedance.
iii) Voltage Gain. Draw the r_e-model equivalent circuit. **(10 Marks)**

1 of 2

06ES.

c. Given a packaged amplifier below, find
i) Voltage gain with $R_L = 4k\Omega$.
ii) Voltage gain with $R_L = 22k\Omega$.
Comment on the result of Part (i) and (ii) (05 Marks)

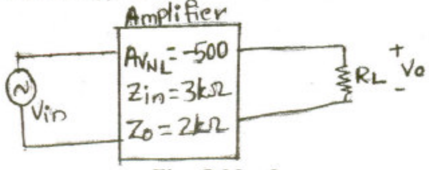

Fig. Q.No. 3c.

4 a. Explain low frequency response of BJT amplifier and give expression for lower cut-off frequency due to C_C, C_E and C_S. (10 Marks)
b. Obtain expression for miller effect input and miller effect output capacitance. (10 Marks)

PART - B

5 a. With necessary equivalent diagram obtain the expression for Z_{in}, A_v, Z_o for a Darlington Emitter follower. (08 Marks)
b. What are the effects of negative feedback? (06 Marks)
c. Obtain expression for Z_{in}, Z_o for a voltage – series feedback. (06 Marks)

6 a. What are the classification of Power Amplifiers based on the location of Q-pt? Also indicate the operating cycle in each case. (06 Marks)
b. Prove that the maximum conversion efficiency in class-B power amplifier is 78.5%. (08 Marks)
c. A power amplifier has harmonic distortions $D_2 = 0.1$, $D_3 = 0.02$, $D_4 = 0.01$, the fundamental current $I_1 = 4A$ and $R_L = 8\Omega$. Calculate the total harmonic distortion, fundamental power and total power. (06 Marks)

7 a. Explain characteristics of a quartz crystal. With a neat diagram explain the crystal oscillator in Parallel – resonant circuits. (10 Marks)
b. Explain how a feedback circuit can be used as oscillator. (04 Marks)
c. Calculate operating frequency of a BJT phase – Shift oscillator for $R = 6k\Omega$, $C = 1500pF$, $R_C = 18k\Omega$. Determine minimum current gain of transistor required for sustained oscillations. (06 Marks)

8 a. Define transconductance g_m. Derive expression for g_m. (06 Marks)
b. A JFET has $g_m = 6mV$ at $V_{GS} = -1V$. Find I_{DSS} if pintch off voltage $V_P = -2.5V$. (04 Marks)
c. With necessary equivalent circuit obtain the expression for A_v, Z_{in}, Z_o for a fixed-biased JFET Amplifier. (10 Marks)

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USN

06ES32

Third Semester B.E. Degree Examination, June-July 2009
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least Two questions from each part.*
2. Make suitable assumptions if necessary.

PART - A

1 a. With respect to a semiconductor diode, explain the following:
i) Reverse Recovery time
ii) Diffusion capacitance. (06 Marks)

b. How does a clamping circuit differ from a clipping circuit? For the diode clipping circuit shown in Fig.1(b), draw the input and output waveforms for i) R = 100 Ω; ii) R = 1kΩ; iii) R = 10kΩ for $V_i = 20$ Sinwt and $V_R = 10V$. Assume Rf = 100Ω, Rr = ∞ and $V_r = 0$. (08 Marks)

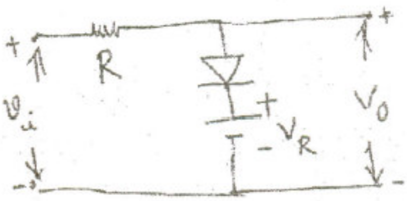

Fig.1(b).

c. Draw the circuit diagram of a full wave rectifier with capacitor filter. The circuit uses a capacitor of 1000 μF and provides a d.c. load current of 500 mA at 2% ripple. Assume f = 50Hz. Calculate i) D.C. output voltage; ii) Peak rectified voltage and % regulation. (06 Marks)

2 a. What is meant by transistor biasing? Compare different biasing methods used for transistor biasing with respect to stability. (05 Marks)

b. Find the operating point for the voltage divider bias circuit with β = 80 and V_{BE} = 0.6V. Find the new operating point when β changes to 100 and V_{BE} changes to 0.25. Given V_{cc} = 15V, R_1 = 100kΩ, R_2 = 18kΩ, R_c = 4.7kΩ, R_E = 1kΩ. (07 Marks)

c. With the help of a neat circuit diagram, explain the use of transistor as an inverter. (08 Marks)

3 a. What are the advantages of using hybrid model to represent the transistor? Explain how h-parameters can be obtained from the static characteristics of the transistor. (06 Marks)

b. For the Emitter follower circuit, derive expressions for A_V, A_I, R_{in} and R_o of an emitter follower. (08 Marks)

c. Compare the characteristics of CE, CC, CB configurations. A CE amplifier uses R_L = 200Ω. The h-parameters are h_{ie} = 1100Ω, $h_{re} = 2.5 \times 10^{-4}$, h_{fe} = 50 and h_{oe} = 22 μA/V. Calculate i) Current gain; ii) Input impedance (06 Marks)

4 a. What is Miller effect? Draw the high frequency transistor a.c. equivalent circuit (π-Model) and explain the significance of each component in the model. (08 Marks)

b. What are the factors that influence the low frequency and high frequency response of a CE – BJT amplifier? (06 Marks)

c. Calculate the overall lower 3dB and upper 3dB frequencies for a 3 stage amplifier having an individual lower 3dB frequency of 30 Hz and upper 3dB frequency of 2.5 MHz. (06 Marks)

06l

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5 a. Why do we cascade amplifiers? State the various methods of cascading transistor amp
A given amplifier arrangement has the following voltage gains. $Av_1 = 10$. $Av_2 = 2$
$Av_3 = 40$. What is the overall voltage gain? Also express each gain in dB and determi
total voltage gain in dB. (08 l

b. Explain the operation and characteristics of cascade and Darlington pair connections. (04 l

c. Explain the concept of feedback amplifier. If an amplifier has a bandwidth of 200 kHz
voltage gain of 80, what will be the new bandwidth and gain if a negative feedback of
introduced? (08 l

6 a. How are power amplifier classified? Explain. Show that the transformer coupled c
amplifier has a maximum efficiency of 50%. (08

b. With circuit diagram, explain the working of class B push pull amplifier. Obt
expression for the maximum conversion efficiency. (07

c. What is harmonic distortion? A transistor supplies 0.85 Watts to a 4kΩ load. The zero
d.c. collector current is 31 mA and the d.c. collector current with signal is 34 mA. Det
the percentage second harmonic distortion. (05 l

7 a. State Barkhausen criteria for sustained oscillations and apply this to R.C phase
oscillator and explain. Write the expression for the frequency of oscillation. Design th
elements of a weinbridge oscillator for operation at $f_o = 10kHz$. (08 l

b. With the help of a circuit diagram, explain the working of Hartely oscillator. A co
oscillator is to generate a frequency of 800 kHz. The capacitors to be used to
capacitance $C_1 = 100\ _pF$ and $C_2 = 10_pF$. Find the value of inductance. (06 l

c. What is frequency stability in oscillators? What factors affect the frequency stab
Explain how crystal oscillator provides good frequency stability. (06 M

8 a. What is a JFET and how does it differ from BJT? Explain the different methods of b
FET. (07 M

b. Explain the operation of JFET amplifier. Draw the FET small signal model. Calcula
transconductance g_m of a JFET having values of $I_{DSS} = 12$ mA and $V_p = -4V$ at bias
i) $V_{GS} = oV$; ii) $V_{GS} = -1.5V$. (06 M

c. Draw a diagram showing the constructional features of a MOSFET. From the di
explain in brief how the voltage at the gate controls the flow of carriers. A dep
MOSFET has $I_{DSS} = 12$ mA and $V_P = -4.5$ V. Calculate the drain current at gate s
voltages of i) OV; ii) –2V; iii) –3V. (07 M

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2 of 2

USN

10ES32

Third Semester B.E. Degree Examination, December 2011

Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Missing data, if any, may be suitably assumed.***

PART – A

1 a. Explain the following with respect to a semiconductor diode :
i) Diffusion capacitance
ii) Transition capacitance and
iii) Reverse recovery time. **(06 Marks)**

b. Explain the working of a half wave rectifier. Also determine ripple factor, efficiency and peak inverse voltage. **(08 Marks)**

c. Determine V_o for the network shown in Fig.Q1(c). Also sketch V_o.

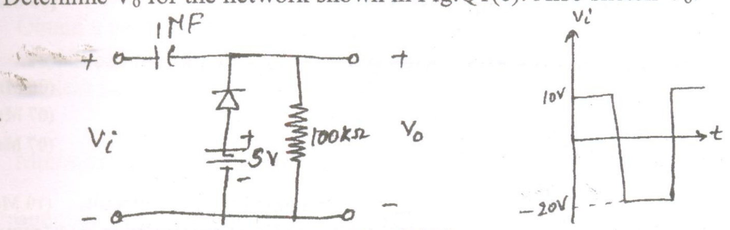

Fig.Q1(c) **(06 Marks)**

2 a. In a voltage divider bias circuit of BJT $R_C = 4K\Omega$, $R_E = 1.5K\Omega$, $R_1 = 39K\Omega$, $R_2 = 3.9K\Omega$, $V_{CC} = 18V$ and $\beta = 70$. Find I_{CQ} and V_{CEQ}. **(08 Marks)**

b. In an emitter bias configuration $I_{CQ} = \frac{1}{2} I_{CSat}$ and $I_{CSat} = 8mA$, $V_{CC} = 28V$ and $V_C = 18V$, $\beta = 110$. Determine R_C, R_E, R_B and stability factor $S(I_{CO})$. **(06 Marks)**

c. Determine R_B and R_C for the transistor inverter of Fig.Q2(c) if $I_{CSat} = 10mA$. **(06 Marks)**

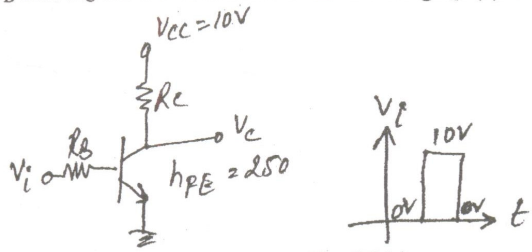

Fig.Q2(c)

3 a. Define h-parameters and hence derive h-parameter model of a CE-BJT. **(06 Marks)**

b. Derive expressions for A_i, A_v, Z_i and Z_o for a voltage divider bias circuit of BJT, using approximate hybrid model of BJT. **(06 Marks)**

c. A voltage source of negligible internal resistance drives a common collector transistor amplifier. The load resistance is 2500 Ω. The transistor h-parameters are $h_{ic} = 1000\Omega$, $h_{rc} = 1$, $h_{fc} = -50$ and $h_{oc} = 25\mu A/v$. Compute A_i, A_v, Z_i and Z_o. **(08 Marks)**

4 a. Explain the effect of coupling capacitor and bypass capacitor on the low frequency respon of a BJT amplifier. (10 Mark

b. Determine the lower cut off frequency for the voltage divider bias BJT amplifier wi C_S = 10μF, C_C = 1μF, C_E = 20 μF, R_S = 1KΩ, R_1 = 10KΩ, R_2 = 10KΩ, R_E = 2K R_C = 4KΩ and R_L = 2.2KΩ, β = 100, $r_o = \infty$ and V_{CC} = 20V. (10 Mark

PART – B

5 a. Derive expressions for Z_i and A_i for a Darlington emitter follower circuit. (08 Mark

b. A 2 stage cascaded amplifier system is built with stage voltage gains 25 and 40. Both stage have the same bandwidth of 220 kHz with identical lower cutoff frequency of 500 Hz. Fin the overall gain bandwidth product. (06 Marks

c. Mention the types of feedback connections. For any one type, derive the gain, with feedbac and compare it with that without feedback. (06 Marks

6 a. Explain the operation of a transformer coupled class-A amplifier. (08 Marks)

b. A class-B amplifier using a supply of V_{CC} = 30V and driving a load of 16Ω, determine th maximum input power, output power and transistor dissipation. (06 Marks)

c. Explain the causes of distortion in an amplifier. Also define THD. (06 Marks)

7 a. Explain Barkhausen criterion for oscillation. Also give the classification of oscillators. (06 Marks)

b. Explain the working of Wien bridge oscillator. (07 Marks)

c. Explain the working of BJT Colpitt's oscillator. (07 Marks)

8 a. Derive expression for V_{GSQ}, I_{DQ}, V_{DS}, V_S, V_G and V_D for a self bias FET circuit. (10 Marks)

b. Explain the depletion and enhancement type MOSEFTs, their characteristics and frequency response. (10 Marks)

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10ES33 – LOGIC DESIGN

SYLLABUS

Sub Code: 10ES33	I A Marks: 25
Hours / Week: 04	Exam Hours: 03
Total Hours: 52	Exam Marks: 100

Academic Year 2012-13

Unit 1:
Principles of combinational logic-1:
Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations

Unit 2:
Principles of combinational Logic-2: Quine-McCluskey minimization technique- Quine-McCluskey using don't care terms, Reduced Prime Implicant Tables, Map entered variables

Unit 3:
Analysis and design of combinational logic - I: General approach, Decoders-BCD decoders, Encoders.

Unit 4:
Analysis and design of combinational logic - II: Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractors-Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.

Unit 5:

Sequential Circuits – 1: Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The ***R S*** Latch, The gated SR Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip- Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop.

Unit 6:
Sequential Circuits – 2: Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops

Unit 7:
Sequential Design - I: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis,

Unit 8:
Sequential Design - II: Construction of state Diagrams, Counter Design

TEXT BOOKS:

1. "Digital Logic Applications and Design", John M Yarbrough, Thomson Learning, 2001.
2. "Digital Principles and Design ", Donald D Givone, Tata McGraw Hill Edition, 2002.

REFERENCE BOOKS:

1. "Fundamentals of logic design", Charles H Roth, Jr; Thomson Learning, 2004.
2. "Logic and computer design Fundamentals", Mono and Kim, Pearson, Second edition, 2001.
3. "Logic Design", Sudhakar Samuel, Pearson/Saguine, 2007

LESSON PLAN

Subject: Logic Design Subject Code: 10ES33

Total No. of Hours –52

Academic Year 2012-13

HOU RS	TOPICS TO BE COVERED
1	**Principles of combinational logic-1**: Binary codes and arithmetic
2	Review of Boolean switching algebra.
3	Definition of combinational logic
4	Canonical forms,
5	Generation of switching equation from truth tables,
6	Karnaugh maps-3, 4 and 5 variables,.
7	Incompletely specified functions (Don't care terms),simplifying max term equations.
8	Incompletely specified functions (Don't care terms),simplifying max term equations.
9	Principles of combinational logic-2: Quine – McCluskey minimization technique
10	Quine – McCluskey using dontcare terms,
11	Reduced prime implicants table
12	Map entered variables,
13	Logic combinational circuits-logic symbols,
14	Conversion to bubble logic, synthesizing functions using bubble notation,.
15	Mixed multiple output functions..
16	**Analysis and design of combinational logic-I**: General approach,
17	Decoders-
18	Decoders-
19	BCD decoders
20	BCD decoders
21	Encoders
22	**Unit 4: Analysis and design of combinational logic-II** Digital multiplexers-using multiplexers as Boolean function generators,
23	Digital multiplexers-using multiplexers as Boolean function generators,
24	Look ahead carry,binary comparators
25	Sequential circuits-1: Basic bistable element, latches, SR latch, Application of SR latch, A switch debouncer, the SR latch,
26	The gated SR latch,the gated d latch,
27	The master slave flip flops(pulse-triggered flip-flops):
28	The master slave SR flipflop,
29	The master-slave JK flipflop,edge triggered flip-flop:
30	The Positive edge triggered D flip-flop,
31	Negative-edge triggered D flip-flop
32	Sequentialcircuits-2: , characteristic equations.

HOURS	TOPICS TO BE COVERED
33	Registers and counters, binary ripple counters, ,
34	Synchronous binary counters
35	Counters based on shift registers,
36	Design of synchronous counters,
37	Design of a synchronous Mod-6 counters using clocked JK flip flops,D,T & SR F/F
38	Design of a synchronous Mod-6 counters using clocked JK flip flops,D,T & SR F/F
39	Sequential Design-1: Introduction, mearly and moore models,
40	State machine notation,
41	State machine notation,
42	Synchronous sequential circuit analysis
43	Synchronous sequential circuit analysis
44	Synchronous sequential circuit analysis
45	**Unit 8: Sequential Design-1I:** Construction of state diagrams
46	Construction of state diagrams
47	Construction of state diagrams
48	counter design
49	counter design
50	counter design
51	counter design
52	counter design

QUESTION BANK(LOGIC DESIGN-10ES33)

1.Explain the combinational logic.

2.Explain the Canonical forms with a example.

3.Explain Generation of switching equations from truth tables with a example.

4.How to Simplifying Max term and Min term equations,

5.Explain Karnaugh maps with example.

6.Explain Quine-McCluskey minimization technique with example. 7.Explain Map entered variables with example.

8. Explain Decoders-BCD decoders, Encoders.

9.Explain Digital multiplexers and demultiplexers.

10.Explain Adders and subtractors -Cascading full adders, Look ahead carry, Binary comparators.

11.Explain Basic Bistable Element, Latches, SR Latch & Application of SR Latch.

12.Explain the gated SR Latch, The gated D Latch & The Master-Slave Flip-Flops.

13.Explain The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop.

14.Explain The Positive Edge-Triggered D Flip-Flop & Negative-Edge Triggered D Flip-Flop.

15.Explain Registers, Counters, Binary Ripple Counters, Synchronous Binary counters.

16.Explain Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops.

17. Explain Design of a Synchronous Mod-6Counter using clocked D, T, or SR Flip-Flops.

18.Explain Design of a Synchronous counters.

VTU QUESTION PAPERS

USN | | | | | | | | | | | 06ES33

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Show that $y = f(ABCD) = \sum(0, 2, 5, 7, 8, 10, 13, 15)$ is the complement of $y = f(ABCD) = \pi(1, 3, 4, 6, 9, 11, 12, 14)$. Illustrate your answer using Karnaugh map to show the complement nature of the two equations. Realize both the functions using 7486 IC chip [Exclusive OR gates] only. **(12 Marks)**

b. Design a logic circuit that controls the passage of a signal 'A' according to the following requirement.
i) Output 'X' will equal 'A' when control inputs B and C are the same.
ii) 'X' will remain 'HIGH' when B and C are different
Implement the circuit using suitable gates. **(08 Marks)**

2 a. Simplify the following expression using Quine- McClusky technique. Implement the simplified circuit using basic gates: $f(ABCD) = \sum(1, 3, 4, 5, 6, 9, 11, 12, 13, 14)$. **(12 Marks)**

b. Simplify the following Boolean expression using VEM technique. [3 variable map].
$f(ABCD) = \sum m(0, 4, 5, 6, 13, 14, 15) + dc(2, 7, 8, 9)$

A	B	C	D	f
0	0	0	0	1
0	0	0	1	0
0	0	1	0	ϕ
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	ϕ

A	B	C	D	f
1	0	0	0	ϕ
1	0	0	1	ϕ
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

ϕ = don't care term. **(08 Marks)**

3 a. Design a logic circuit using a 3 to 8 logic decoder that has active low data inputs, an active HIGH enable and active low data outputs. Use such a decoder to realize the full adder circuit. **(08 Marks)**

b. Design a suitable BCD adder circuit using 74LS83 and a provision has to be made for self correction in case if the sum is not a valid BCD number format. **(12 Marks)**

4 a. Implement the following Boolean function using 4 :1 MUX
$y(ABCD) = \sum m(0, 1, 2, 4, 6, 9, 12, 14)$. **(10 Marks)**

b. Design a circuit that accepts 2 unsigned 4 bit numbers and provides 3 outputs. The inputs are $A_3 A_2 A_1 A_0$ and $B_3 B_2 B_1 B_0$. Outputs are A = B, A > B and A < B. Draw the logic diagram. **(10 Marks)**

1 of 2

06ES33

PART – B

5 a. Explain the following:
   i) Switch debouncing and it's elimination
   ii) Race around problem and its elimination. **(14 Marks)**

b. Obtain the characteristic equation for the following flip flops:
   i) JK flip flop
   ii) SR flip flop. **(06 Marks)**

6 a. With the help of a diagram, explain the following with respect to shift register:
   i) Parallel in and serial out
   ii) Ring counter and twisted ring counter. **(08 Marks)**

b. Design a Mod – 5 synchronous counter using JK flip flop. **(12 Marks)**

7 a. With a suitable example, explain Mealy and Moore model in a sequential circuit analysis. **(10 Marks)**

b. A sequential circuit has one input and one output. The state diagram is as shown in Fig.7(b). Design a sequential circuit with 'T' flip flop. **(10 Marks)**

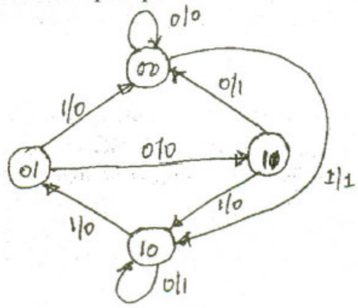

Fig.7(b).

8 a. Analyse the following sequential circuit shown in Fig.8(a) and obtain:
   i) Flip flop input and output equations.
   ii) Transition equation
   iii) Transition table
   iv) State table
   v) Draw the state diagram. **(12 Marks)**

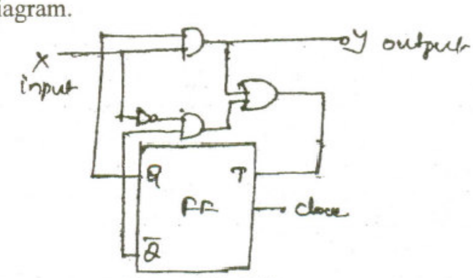

Fig.8(a).

b. With a suitable example and appropriate state diagram, explain how to recognize a particular sequence. Ex: 1011. (Any sequence can be assumed). **(08 Marks)**

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2 of 2

USN | | | | | | | | | | 06ES33

Third Semester B.E. Degree Examination, June-July 2009
Logic Design

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Express the P. O. S. equations in a Maxterms list (decimal notations) form. (04 Marks)
i) $T = f(a, b, c) = (a + \overline{b} + c)(a + \overline{b} + c)(\overline{a} + \overline{b} + c)$
ii) $J = f(A,B,C,D) = (A+\overline{B}+C+D)(A+\overline{B}+C+\overline{D})(\overline{A}+B+C+D)(\overline{A}+\overline{B}+C+D)(\overline{A}+B+\overline{C}+D)(\overline{A}+\overline{B}+\overline{C}+D)$

b. Reduce the following function using K-map technique and implement using gates. (10 Marks)
i) $f(P, Q, R, S) = \Sigma m(0, 1, 4, 8, 9, 10) + d(2, 11)$
ii) $f(A, B, C, D) = \pi M(0, 2, 4, 10, 11, 14, 15)$

c. Design a logic circuit with inputs P, Q, R so that output S is high whenever P is zero or whenever Q = R = 1. (06 Marks)

2 a. Using Quine Mccluskey Method and simply the following function.
$f(a, b, c, d) = \Sigma m(0, 1, 2, 3, 8, 9)$ (10 Marks)

b. Write the Map entered variable K-map for the Boolean function.
$f(w, x, y, z) = \Sigma m(2, 9, 10, 11, 13, 14, 15)$ (10 Marks)

3 a. Implement following multiple output function using 74LS138 and extend gates.
$F_1(A, B, C) = \Sigma m(1, 4, 5, 7)$
$F_2(A, B, C) = \pi M(2, 3, 6, 7)$ (06 Marks)

b. Implement full subtractor using decoder and write a truth table. (08 Marks)

c. Write a note on encoders. (06 Marks)

4 a. Design 2-bit comparator using gates. (12 Marks)

b. Implement the following Boolean function using 8 : 1 multiplexer.
$F(A, B, C, D) = \overline{A}B\overline{D} + ACD + \overline{B}CD + \overline{A}\,\overline{C}D$ (08 Marks)

PART – B

5 a. Clearly distinguish between
i) Synchronous and asynchronous circuits.
ii) Combinational and sequential circuits (06 Marks)

b. Explain the operation of clocked SR flip-flop. (08 Marks)

c. What is race around condition? Discuss in detail. (06 Marks)

6 a. Draw the logic diagrams for (i) SR latch (ii) Master – slave JK flip-flop (iii) Master-slave SR flip-flop. (06 Marks)

b. Explain the working of 4-bit asynchronous counter. (06 Marks)

c. Explain Johnson counter with its circuit diagram and timing diagram. (08 Marks)

7 a. Explain with suitable logic and timing diagram.
i) Serial-in serial-out shift register.
ii) Parallel-in parallel-out shift register. (10 Marks)

b. Explain the Mealy model and Moore model for clocked synchronous sequential network. (10 Marks)

8 a. Compare Moore and Meelay models. (04 Marks)

b. Design a synchronous counter using JK flip-flops to count in the sequence 0,1,2,4,5,6,0,1,2....... Use state diagram and state table. (12 Marks)

c. State the rules for state assignments. (04 Marks)

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USN | | | | | | | | | | 06ES33

Third Semester B.E. Degree Examination, Dec.08/Jan.09
Logic Design

Time: 3 hrs. Max. Marks:100

Note:1. ***Answer any FIVE full questions, choosing at least two questions from each part A & B.***
2. ***Missing data be suitably assumed.***

Part A

1 a. Convert the given boolean function $f(x,y,z)=[x+\bar{x}\bar{z}(y+\bar{z})]$ into maxterm canonical formula and hence highlight the importance of canonical formula. **(05 Marks)**

b. Distinguish the prime implicants and essential prime implicants. Determine the same of the function $f(w,x,y,z)=\sum m(0,1,4,5,9,11,13,15)$ using K-map and hence the minimal sum expression. **(05 Marks)**

c. Design a combinational logic circuit, which converts BCD code into Excess-3 code and draw the circuit diagram. **(10 Marks)**

2 a. Using Quine-Mcluskey method and prime implicant reduction table, obtain the minimal sum expression for the Boolean function $f(w,x,y,z)=\sum m(1,4,6,7,8,9,10,11,15)$. **(12 Marks)**

b. Obtain the minimal product of the following Boolean functions using VEM technique:
$f(w,x,y,z)=\sum m(1,5,7,10,11)+dc(2,3,6,13)$ **(08 Marks)**

3 a. Realize the following functions expressed in maxterm canonical form in two possible ways using 3–8 line and decoder:
$f_1(x_2,x_1,x_0)=\pi M(1,2,6,7)$
$f_2(x_2,x_1,x_0)=\pi M(1,3,6,7)$ **(10 Marks)**

b. What are the problems associated with the basic encoder? Explain, how can these problems be overcome by priority encoder, considering 8 input lines. **(10 Marks)**

4 a. Implement the function $f(w,x,y,z)=\sum m(0,1,5,6,7,9,10,15)$ using a 4 : 1 MUX with w, x as select lines: **(08 Marks)**

b. The 1-bit comparator had 3 outputs corresponding to x > y, x = y and x < y. It is possible to code these three outputs using two bits S_1S_0 such as S_1, S_0 = 00, 10, 01 for x = y, x > y and x < y respectively. This implies that only two-output lines occur from each 1–bit comparator. However at the output of the last 1–bit comparator, an additional network must be designed to convert the end results back to three outputs. Design such a 1–bit comparator as well as the output converter network. **(12 Marks)**

Part B

5 a. What is a Flip Flop? Discuss the working principle of SR Flip Flop with its truth table. Also highlight the role of SR Flip Flop in switch debouncer circuit. **(08 Marks)**

b. With neat schematic diagram of master slave JK-FF, discuss its operation. Mention the advantages of JK-FF over master-slave SR-flip-flop. **(12 Marks)**

1 of 2

06ES33

6 a. Design a 4-bit universal shift register using positive edge triggered D flip-flops to operate as shown in the table below Q6 (a) **(12 Marks)**

Select line		Data line selected	Register operation
S_0	S_1		
0	0	I_0	HOLD
0	1	I_1	Shift RIGHT
1	0	I_2	Shift LEFT
1	1	I_3	Parallel load

Table Q6 (a)

b. Explain the working principle of a mod-8 binary ripple counter, configured using positive edge triggered T-FF. Also draw the timing diagram. **(08 Marks)**

7 a. Distinguish between Moore and Mealy model with necessary block diagrams. **(08 Marks)**

b. Give output function, excitation table and state transition diagram by analyzing the sequential circuit shown in figure Q7 (b) **(12 Marks)**

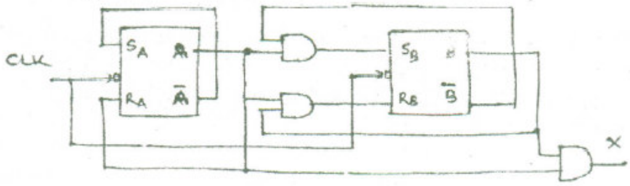

Fig. Q7 (b)

8 a. Construct Moore and Mealy state diagram that will detect input sequence 10110, when input pattern is detected, z is asserted high. Give state diagrams for each state. **(10 Marks)**

b. Design a cyclic mod 6 synchronous binary counter using JK flip-flop. Give the state diagram, transition table and excitation table. **(10 Marks)**

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2 of 2

USN | | | | | | | | | |

10ES33

Third Semester B.E. Degree Examination, December 2011

Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Expand $f_1 = a + bc + a\bar{c}d$ into minterms and $f_2 = a(b + c)(a + c + \bar{d})$ into maxterms. **(06 Marks)**

b. Simplify $f(a, b, c, d) = \Sigma m(1, 2, 4, 11, 13, 14, 15) + dc(0, 5, 7, 8, 10)$ using Karnaugh map technique. **(05 Marks)**

c. Obtain a minimal SOP expression for the function $f(a, b, c, d, e) = \Sigma m(3, 7, 11, 12, 13, 14, 15, 16, 18) + dc(24, 25, 26, 27, 28, 29, 30, 31)$ using Karnaugh map method. **(05 Marks)**

d. Explain canonical form of Boolean equations with an example. **(04 Marks)**

2 a. Minimize $f(a, b, c, d) = \pi(0, 6, 7, 8, 9, 13) + \pi dc(5, 15)$ using quine Mc cluskey method. **(12 Marks)**

b. Simplify $f(a, b, c, d) = \Sigma m(2, 3, 4, 5, 13, 15) + dc(8, 9, 10, 11)$ taking least significant bit as map entered variable. **(08 Marks)**

3 a. Design and implement a 4 bit look ahead carry adder. **(14 Marks)**

b. Implement 16:1 multiplexer using 4:1 multiplexers. **(06 Marks)**

4 a. Design and implement a 2 BIT digital comparator. **(09 Marks)**

b. Implement a full subtractor using 3 – 8 line decoder with the decoder having high outputs and active low enable thermal. **(05 Marks)**

c. Implement the Boolean function $f(a, b, c, d) = \Sigma m(0, 1, 5, 6, 7, 9, 10, 15)$ using multiplexer with a, b connected to select lines s_1, s_0. **(06 Marks)**

PART – B

5 a. Give the NAND – NAND implementation of a gated SR latch with preset and clear facilities, such that when preset = 0, the output should be 1 while clear = 0, the output be 0. Give the truth table clearly indicating gate, clear, preset and input signals and the corresponding outputs. **(07 Marks)**

b. Explain the working of a pulse triggered JK master slave flip flop with a truth table. **(06 Marks)**

c. Explain the functioning of positive edge triggered D – flip flop. **(07 Marks)**

1 of 2

10ES33

6 a. Explain 4 bit universal shift register using negative edge triggered D – flip flops. **(08 Marks)**
b. Give the circuit of a 4 bit JOHNSON counter using negative edge triggered D flip flops. Draw the timing waveforms with respect to clock starting with an initial state of $Q_3Q_2Q_1Q_0 = 0000$. What is the modulus of this counter? **(08 Marks)**
c. What is meant by triggering of flip flops? Name the different triggering methods. **(04 Marks)**

7 a. Compare synchronous and ripple counters. **(03 Marks)**
b. Draw the circuit of a 3 BIT, asynchronous, down counter using negative edge triggered JK flip flops and draw the timing waveforms. **(05 Marks)**
c. Design and implement a synchronous counter to count the sequence 0 – 3 – 2 – 5 – 1 – 0 using negative edge triggered JK flip flops. **(12 Marks)**

8 a. Explain Mealy and Moore machine models. **(06 Marks)**
b. Construct the excitation table, transition table, state table and state diagram for the Moore circuit shown in Fig.Q.8(b). **(14 Marks)**

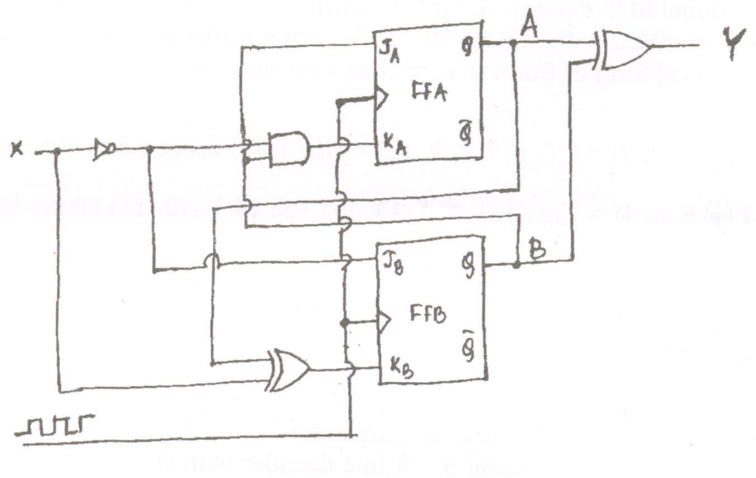

Fig.Q.8(b)

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10ES 34–NETWORK ANALYSIS

SYLLABUS

Sub Code: 10ES 34	I A Marks: 25
Hours / Week: 04	Exam Hours: 03
Total Hours: 52	Exam Marks: 100

Academic Year 2012-13
:
Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh
UNIT 2:
Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie -set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality**.**

UNIT 3:
Network Theorems – 1: Superposition, Reciprocity and Millman's theorems

UNIT 4:
Network Theorems - II:
Thevinin's and Norton's theorems; Maximum Power transfer theorem

PART – B
UNIT 5: Resonant Circuits: Series and parallel resonance, frequency response of series and Parallel circuits, Q –factor, Bandwidth.

UNIT 6:
Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

UNIT 7:
Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis

UNIT 8:
Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets

TEXT BOOKS:
1. "Network Analysis", M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. "Networks and systems", Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.

REFERENCE BOOKS:

1. “Engineering Circuit Analysis”, Hayt, Kemmerly and DurbinTMH 7th Edition, 2010
2. “Basic Engineering Circuit Analysis”, J. David Irwin / R. Mark Nelms, John Wiley, 8th ed, 2006.
3.“ Fundamentals of Electric Circuits”, Charles K Alexander and Mathew N O Sadiku, Tata McGraw-Hill,3rd,2009.

LESSON PLAN

Subject: Network Analysis Subject code:10ES34

Total No. of Hours:52

Academic Year 2012-13

Hours	Topics to be covered
	Chapter 1 – Basic Concepts
01	Network Topology, Network, Network element, Branch, Node, mesh, Circuit Elements, Energy Sources.
02	Series and parallel connection of elements. Network reduction and problem on network reduction
03	Series and parallel connection of elements. Network reduction and problem on network reduction
04	Network Reduction - Using Star – Delta transformation
05	Network Simplification Techniques - Introduction - Classification of Electrical Network - Circuit Elements - Energy Sources - Kirchoff's laws - Review of loop and node - Linearly independent KVL - Linearly independent KCL
06	Solution of Networks using KVL for AC and DC
07	Source shifting problems on KCL, KVL and source shifting.
08	**Chapter 2 – Network Topology**
09	Introduction to Graph theory and Network Equation - Interconnection of passive and active element constitutes an electric network. - Graph, Tree, Incidence Matrix - Linear graph for a network and its oriented graph - Planar graph, Non-planar graph, sub-graph - Rank of a graph, R = N-1 - Tree – Links / Chords,
10	Properties of trees - Incidence Matrix, Properties of Incidence Matrix - Complete Incidence Matrix - Reduced Incidence Matrix
11	Tie - Set Schedule - What do you mean by Tie-set? - How to write Tie-set matrix? - How to solve networks and obtain equilibrium equations using Tie-set schedule? - Using Loop Analysis.
12	Cut- Set Schedule – What do you mean by Cut-set? - How to write Cut-set matrix? - How to solve networks and obtain equilibrium equations using Cut-set schedule? - Using Nodal Analysis
13	Solving examination problems on Incidence Matrix, Tie-set and Cut-set schedule.
14	Network analysis using graph theory. Relation between branch element and loop element and branch voltage and node voltage.
15	Solving examination problems and on cut set and tie set.
16	**Chapter 3 – Network Theorems**
17	Superposition theorem - Explanation of the theorem - Steps to apply superposition theorem - Proof of superposition theorem ,Problems on superposition theorem
18	Thevenin's theorem - Explanation of the theorem - Steps to apply Thevenin's theorem - Proof of Thevenin's theorem
19	Norton's theorem - Explanation of the theorem - Steps to apply Norton's theorem - Proof of Norton's theorem
20	Problems on both thevinins and Norton theorem.
21	Maximum Power Transfer theorem - Explanation of the theorem - Steps to apply Maximum Power Transfer theorem - Proof of Max. Power Transfer theorem
22	Mill man's theorem - Explanation of the theorem - Steps to apply Mill man's

	theorem - Proof of Mill man's theorem
23	Reciprocity theorem - Explanation of the theorem - Steps to apply Reciprocity theorem - Proof of Reciprocity theorem
24	Problems on reciprocity, Millman and Maximum power transfer theorems.

25	**Chapter 4 – Resonant Circuits**
26	Introduction - Series Resonance - Parallel Resonance - Series Resonance - Phasor diagram - Reactance Curves - Variation of impedance and admittance with frequency - Frequencies for maximum Vc and V_L
27	Q Factor - Impedance of series RLC circuit in terms of Qo - Bandwidth and Selectivity - Voltage across L & C at Resonance
28	Q Factor - Impedance of series RLC circuit in terms of Qo - Bandwidth and Selectivity - Voltage across L & C at Resonance
29	Parallel Resonance - Variation of Reactance with frequency - Impedance of parallel resonant circuit in terms of Qo - Impedance of parallel resonant circuit near resonant frequency
30	Bandwidth and Selectivity-Currents in parallel resonant circuit - Relation between Ic and Il.
	Chapter 5 – Transient behavior and Initial Conditions
31	Introduction - Mathematical background of differential equations - General and Particular solutions for homogenous
32	Initial conditions in network - Why study initial conditions - Initial conditions in elements
33	DC Excitation to RC series circuit - What will happen if DC excitation is given to RC circuit before and after initial conditions
34	DC Excitation to RL series circuit - What will happen if DC excitation is given to RL circuit before and after initial conditions
35	DC Excitation to RLC series circuit - What will happen if DC excitation is given to RLC circuit before and after initial conditions
36	AC Excitation to RC series circuit - What will happen if AC excitation is given to RC circuit before and after initial conditions
37	AC Excitation to RLC series circuit - What will happen if AC excitation is given to RLC circuit before and after initial conditions
	Chapter 6 – Laplace transform and Applications
38	Introduction - Laplace transform from Fourier transform - Definition and properties of Laplace transform and Inverse Laplace transform
39	Theorems - Initial and Final value theorem - Shifting theorem - Convolution thm
40	Laplace transform for Standard Functions - Step function - Ramp function - Impulse function - For Periodic and Non-periodic function - Delayed functions
41	Laplace transform for Standard Functions - Step function - Ramp function - Impulse function - For Periodic and Non-periodic function - Delayed functions
42	Network Analysis using Lap lace Transform - Single Resistor in Laplace domain - Single Capacitor in Laplace domain -
43	Single Inductor in Laplace domain - Use of convolution integral in network analysis
44	Transformed Networks and their solutions
	Chapter 7 – Two port Network Parameters
45	Introduction - Terminal pairs or Ports - Functions for one port and two port network - Driving point admittance - Transfer functions - Poles and Zero's
46	Significance of location of Poles and Zero's - Restriction of location of Poles and

	Zero's in S-Plane
47	Time domain behavior from Pole-Zero plot - Determination of network function for a Two Port network
48	Introduction – Relationship of Two Port Variables - Characterization of linear time invariant two port network - Open circuit impedance parameters (Z-Parameters)
49	Short circuit admittance parameters (Y-Parameters)
50	Hybrid Parameters (H-Parameters) - Inverse hybrid parameters
51	ABCD Parameters/Transmission parameters
52	Relationship between parameters - Interconnection of Two Port networks

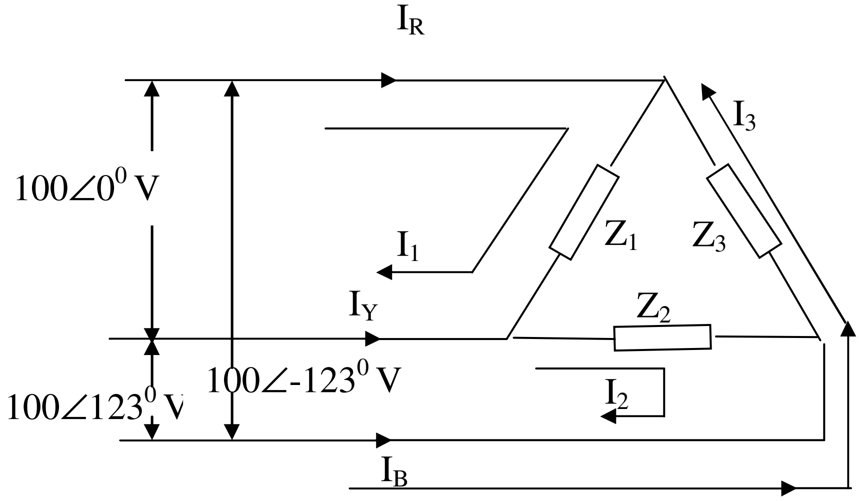
QUESTION BANK

NETWORK ANALYSIS-10ES34

Note; Answer any five questions

1a. Develop a model equation for a general network in the form [Y][V]=[I]
Where [Y] – Admittance Matrix
[V] – Node voltage Matrix
[I] - Source Current Matrix (08)

1b. For the circuit shown in the fig, Determine the line currents I_R , , Iy and I_B using mesh analysis (08)



$Z_2 = Z_3 = Z_1 = 5\angle 10^0$ V

Fig 1b

1c. Explain Source transformation with suitable examples (04)

2a. Using Star- Delta transformation find R_{AB} for the given network shown in fig (05)

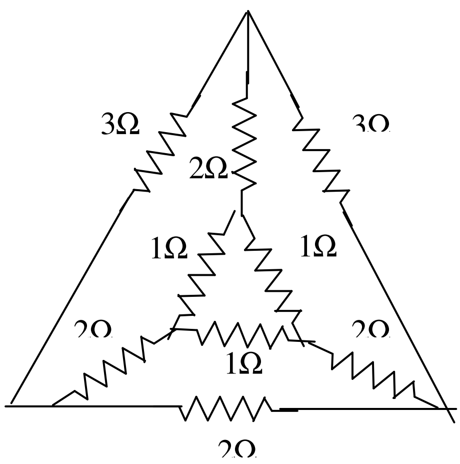


Fig 2a

2b. Explain trees, Cotrees and loops in the graph of a network with suitable examples (05)

2c. Explain incidence of a graph with suitable examples (05)

2d. Write the Tie-set matrix for the graph shown in figure 2d, consisting 1,2,3,4 as tree branches (05)

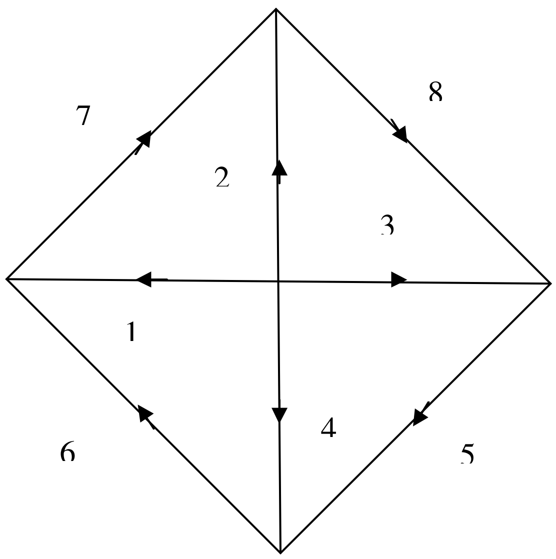
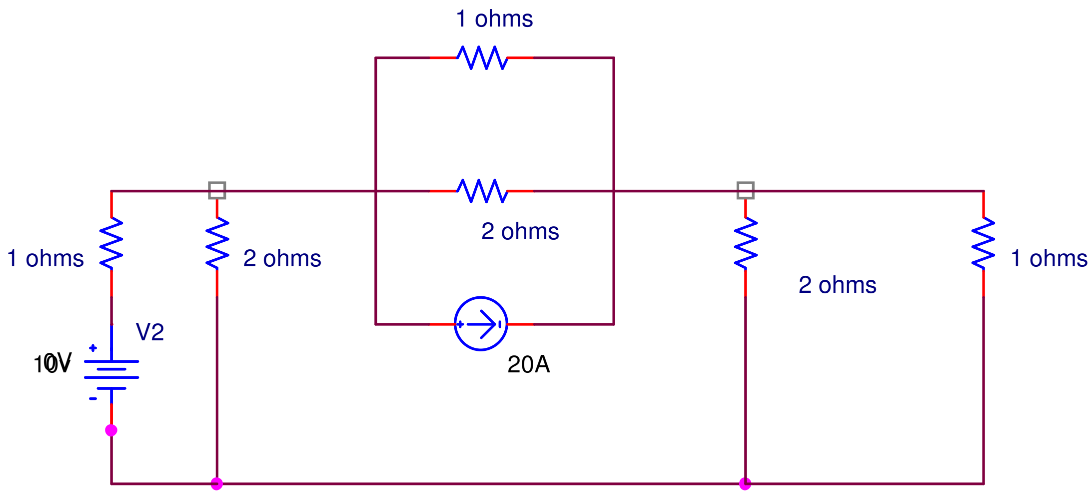
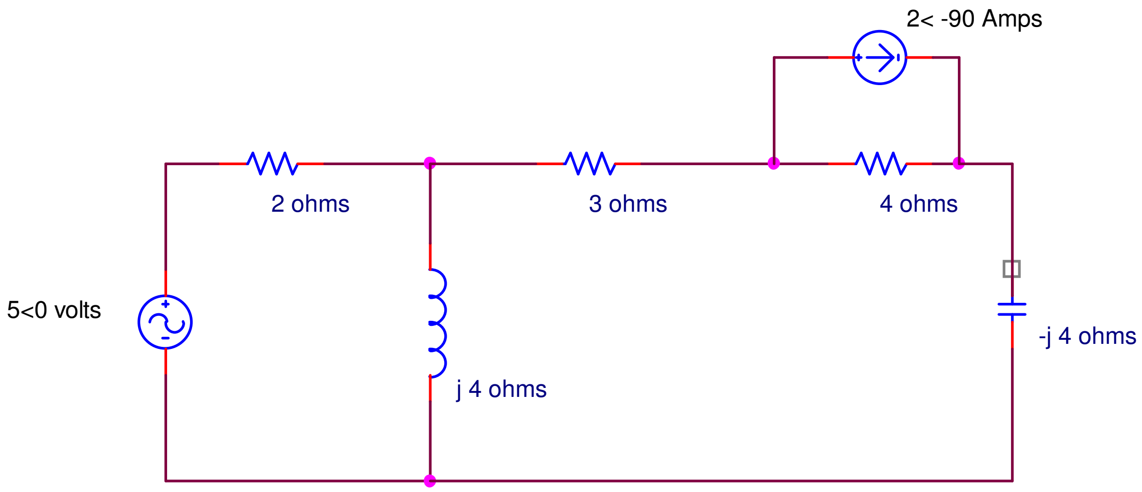


Fig 2d.

3a. For the network shown in fig 3a write the cut set schedule. Obtain equilibrium equations and hence solve for the branch currents and branch voltages (12)



3b. Find the current I in the network shown in fig 3b using super position theorem (08)



4a. Find the currentthrough the load resistance 'R_L` when R_L = 1 ohms and R_L = 5 ohms using Thevenins theorem for the circuit shown in fig 4a. Also prove Thevenins equivalent is the dual of Nortons equivalent (12)

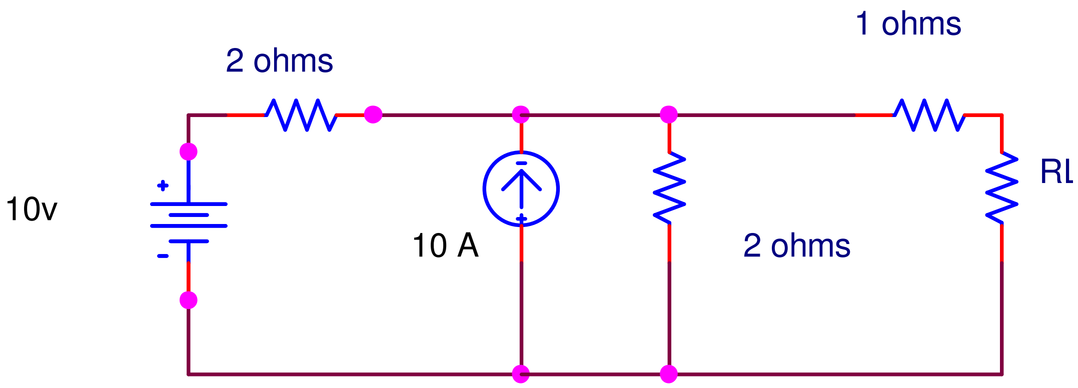


Fig 4a

4b. State and prove Millams Theorem. Using the same calculate the load current I in the circuit shown in fig 4b (08)

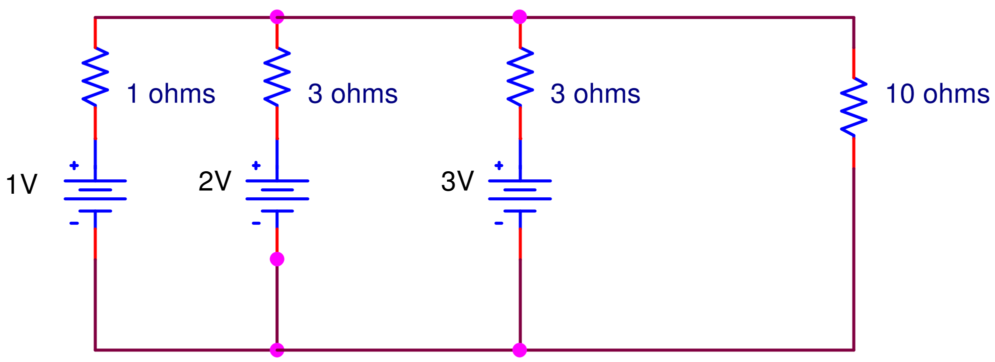


Fig 4b

5a. Define quality factor. What is its significance? (04)

5b. what is the effect of variation of C on selectivity in a series resonance circuit? Derive necessary equations (06)

5c. Define parallel resonance in electrtic network. Obtain the condition for the same. What is the series combination of R and C connected in parallel with the coil of 50 ohms resistance and inductance of 0.5 henries which makes the circuit to resonate with excitation of 100 rad/sec (10)

6a. For the circuit shown in fig 6a. find the current equation when the switch `s' is closed at t=0 (08)

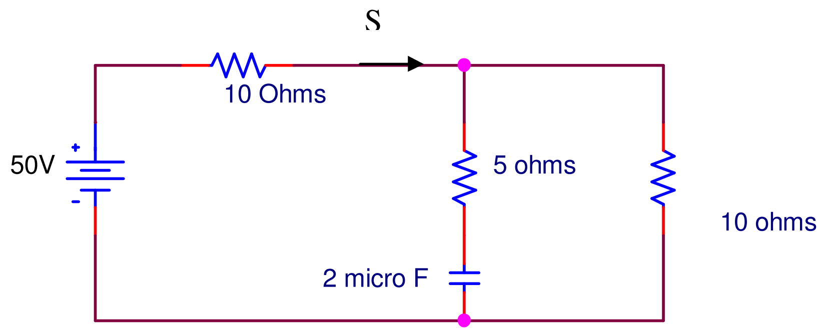
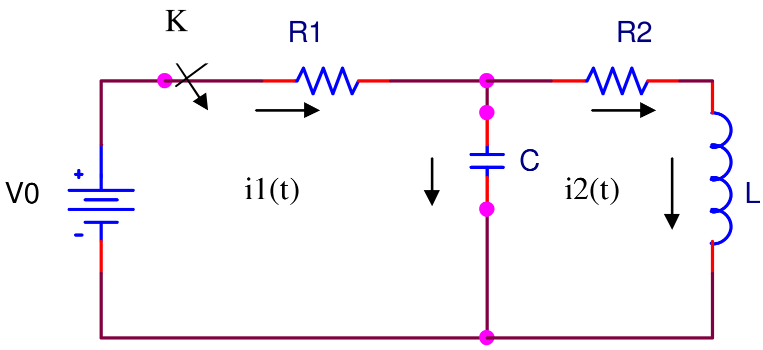


Fig 6a

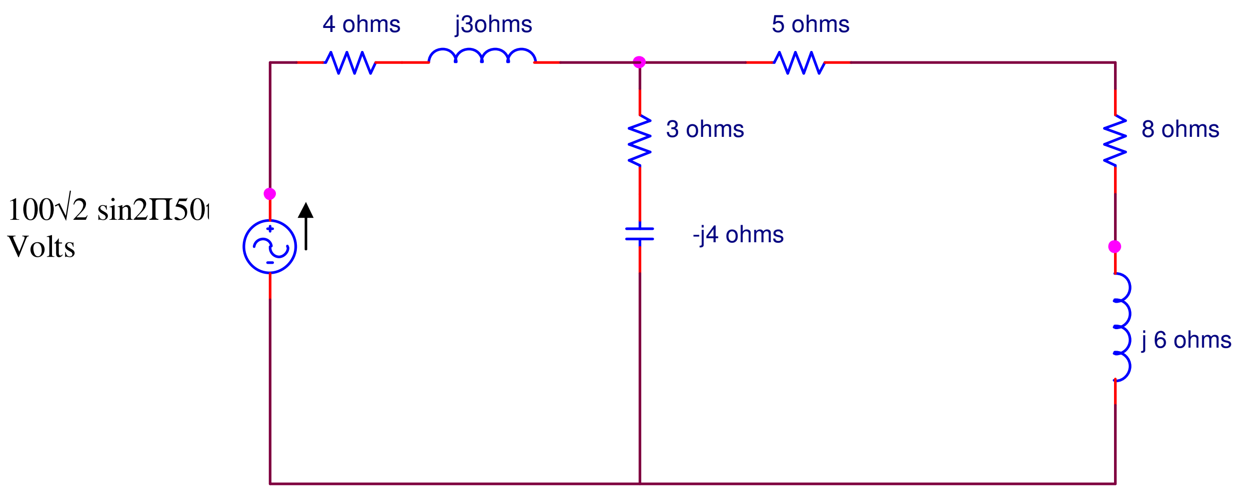
6b. Assuming zero voltage across the capacitor and initial zero current through the inductor of the circuit shown in the fig 6b find Z_1 (0^+), Z_2 (0^+), $di_1(0^+)/dt$, $di_2(0^+)/dt$, $d^2i_1(0^+)/dt^2$, $d^2i_2(0^+)/dt^2$ (12)



7a. If Lf(t)= f(s), then show that Lf(t-t0)= e^{-st_0} F(s). Using the same derive the Laplace transform of a periodic function (06)

7b. Find the time function f(t), given F(s)= $1/S^2(S+2)$ using convolution integral. (06)

7c. Find current i1(t) and i2(t) using Laplace transformation in the network shown in fig 7c. Assume zero initial conditions (08)



Q8a .Define H-parameters and Transmission parameters for the Two-port network. Draw the Equivalent circuit for the H-parameters (07)

8b. For the Two-port network shown in fig 8b. Obtain Z and Y parameters. (08)

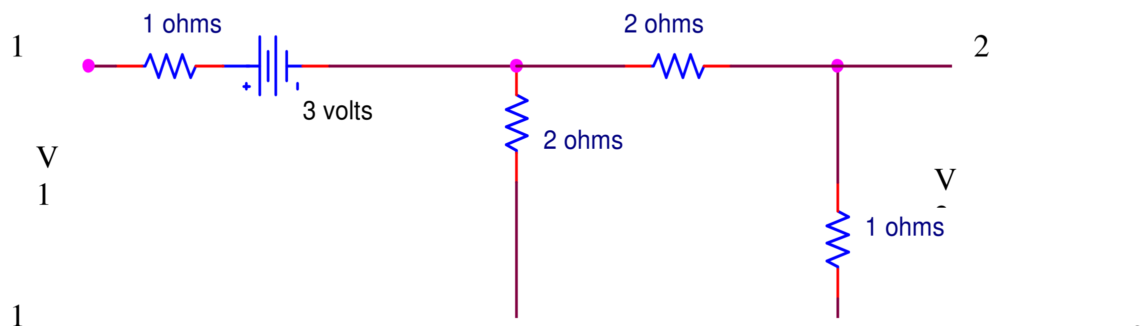


Fig 8b

8c. Explain cascade connection of Two-Port networks. (05)

QUESTION BANK

NETWORK ANALYSIS-10ES34

1a. Define and distinguish the following network elements
- (i) Linear and Nonlinear
- (ii) Active and passive
- (iii) Lumped and Distributed (06)

1b. Using source transformation finds the power delivered by the 50V voltage source in the circuit shown in fig 1b. (05)

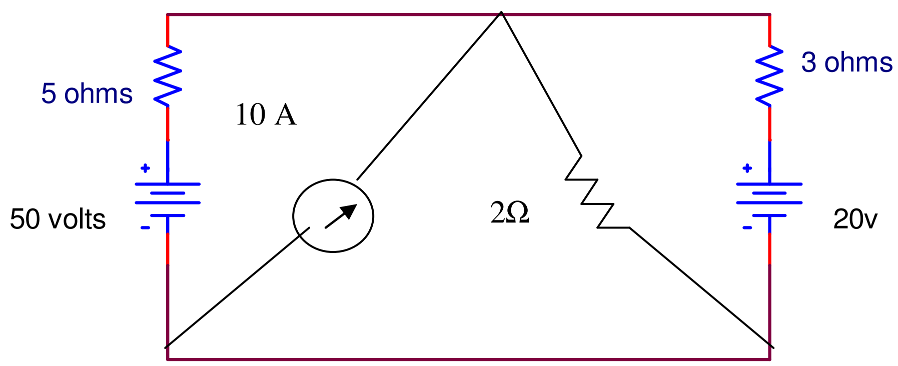
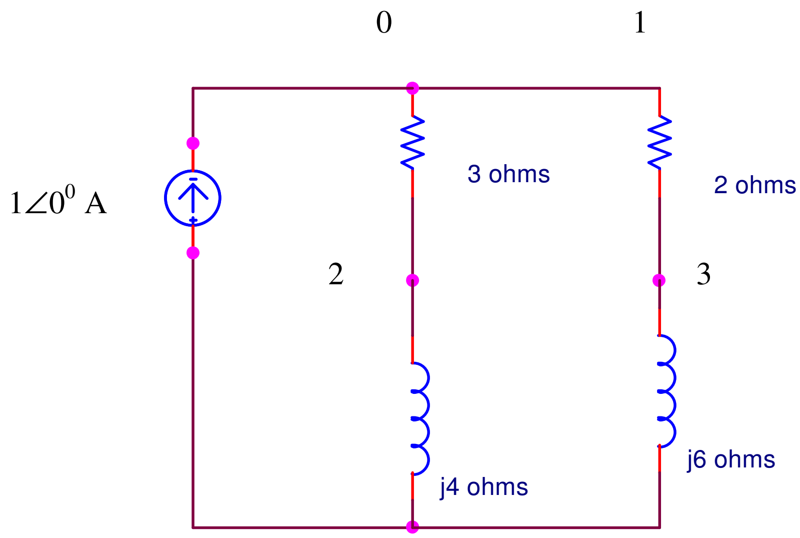


Fig 1b

1c. Determine the voltage V_{23} of Fig 1c by using node analysis (05)



2a. Establish Star-Delta relationship suitably (05)

2b. Explain the following terms with illustrations in connection with network topology
- (i) Tree and Link
- (ii) Planar graph and Non planar graph (06)

2c. Define the loop-set matrix. The basic loop matrix ` B ` of the graph is as given below. Draw the oriented graph. Substantiate each step. (09)

$$B = \begin{array}{c} \\ \end{array}\begin{array}{cccc|cccc} 2 & 3 & 5 & 6 & 1 & 4 & 7 & 8 \\ \hline 1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & -1 & 0 & -1 & 0 & 0 & 1 & 0 \\ 0 & 0 & -1 & -1 & 0 & 0 & 0 & 1 \end{array}$$

3a. For the network shown in fig3a write down the cut set matrix and obtain network equilibrium equations. Using KVL calculates the loop current resistors are in ohms (10)

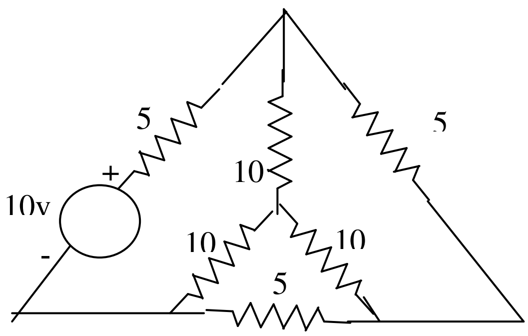
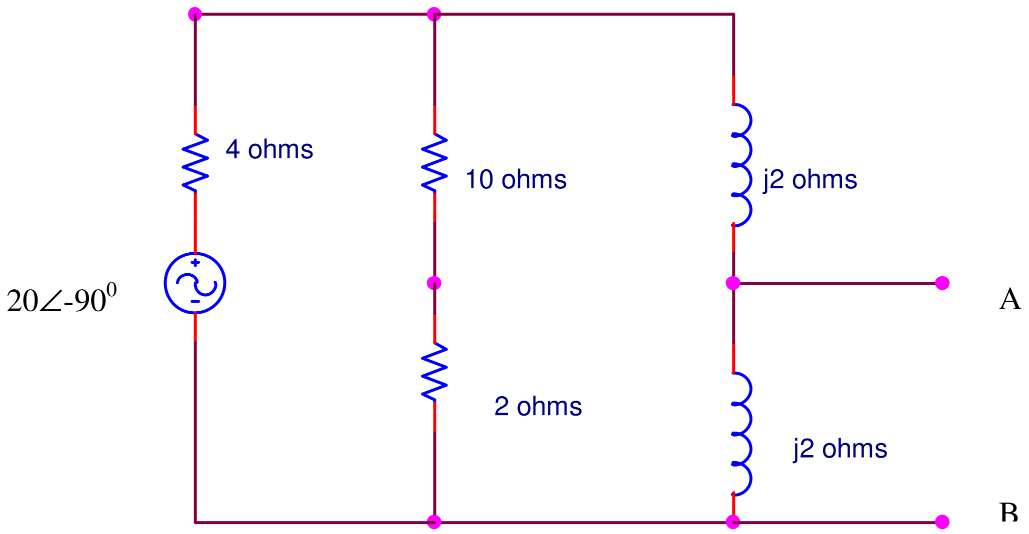


Fig 3a

3b. State and prove Millman's theorem (05)

3c. For the circuit shown in fig 3c. Find V_{AB} and verify Reciprocity Theorem (05)



4a. Explain maximum power transfer theorem. Obtain the condition for maximum power transfer in the following cases (10)

i) AC source, complex source impedence, Load in complex with only resistive element varying

ii) AC source , complex source impedence, Load in complex with only reactive element is varying

4b. Using Thevenin' s theorem , find the current flowing through 4ohms resistor in fig 4b

(10)

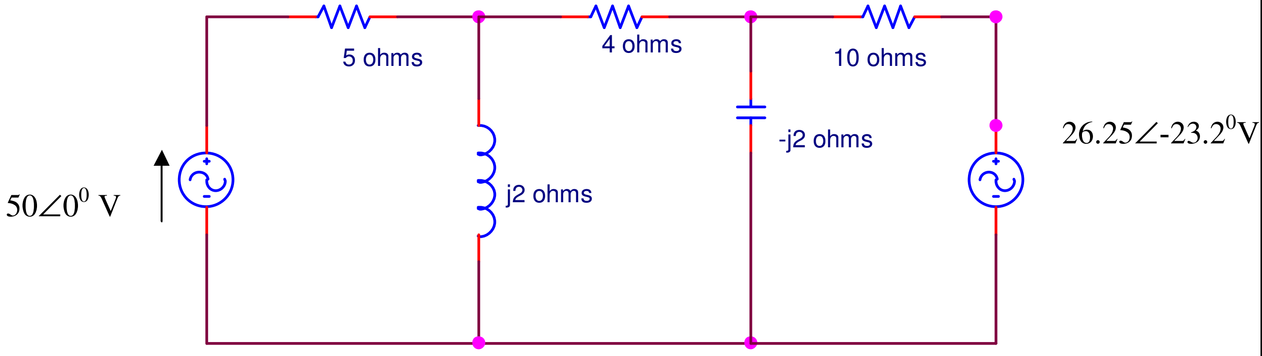


Fig 4b

5a. A RLC series circuit comprising of a 10 ohms resistance is to have a bandwidth of 100 rad/sec. determine the value of capacitance to make the circuit resonate at 400 rad/sec. What will happen to the selectivity property if the resistance is changed to 5 ohms. What are the half power frequencies for the new value of resistance? (08)

5b. Show that the resonant frequency is the geometric mean of the half power frequencies in the series resonant circuit (05)

5c. In the circuit shown in fig 5c, V and I are in phase. Find the value of Z_2 and Q factor (07)

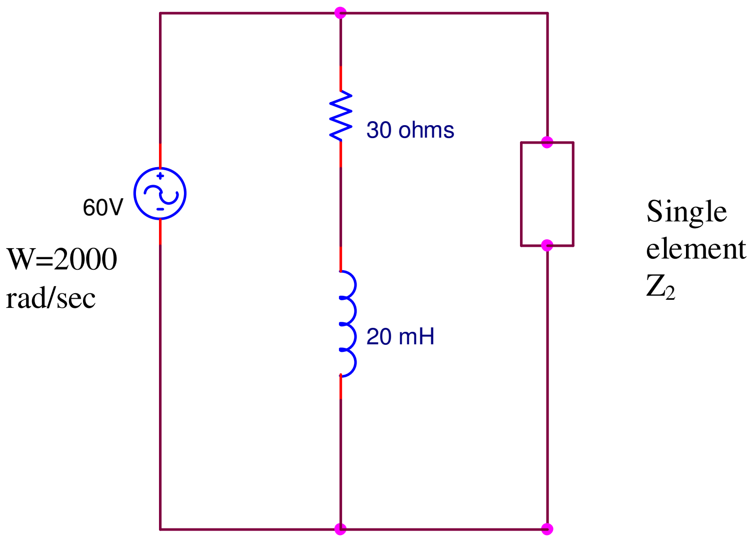
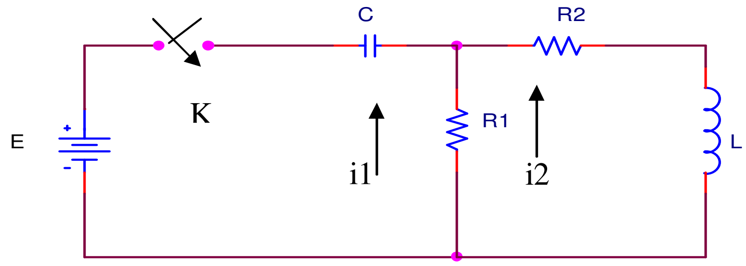
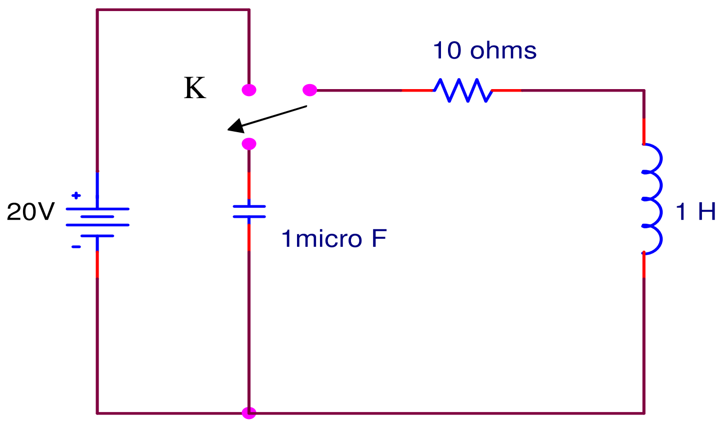


Fig 5c

6a. Illustrate the procedure to determine the transient and steady state response of the circuit shown in fig 6a. when switch K is closed at $t=0^+$. Assume all initial conditions are zero. Also compute di1/dt and di2/dt at $t=0^+$ (10)



6b. In the circuit shown in fig 6b. switch K is closed from 20 V to 1μF at time t=0, steady state condition having been reached before switching. Find the values of i, di/dt and di^2/dt^2 all at t= 0+ (10)



7a. State and prove initial and final value theorems. Also find initial and final values of the following: (07)

$I(s) = S^2+5/ S^3+2S^2+4S$

7b. Construct the following waveform shown in fig 7b using step function and find the Laplace transform for the same, if the waveform is repeated after 4 sec. What is the Laplace transform for this periodic function (07)

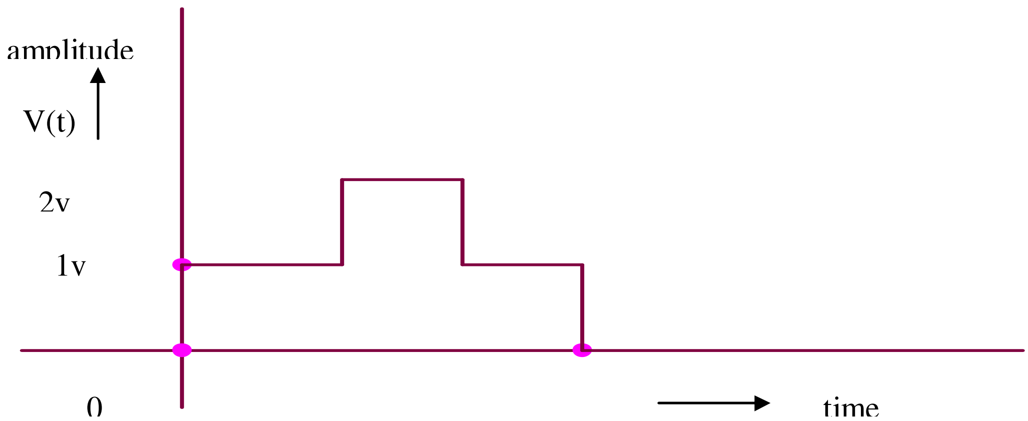


Fig 7b.

7c. State and prove convolution integral. Also find f(t) using convolution integral for the following

F(s) = 1/(s+a)s (06)

8a. Define Y and Z parameters. Derive the relation such that Y parameters expressed in terms of Z parameters and Z parameters expressed in terms of Y parameters (12)

8b. Find 'h' parameters of the network shown in fig 8b. and draw the 'h' parameter equivalent circuit (08)

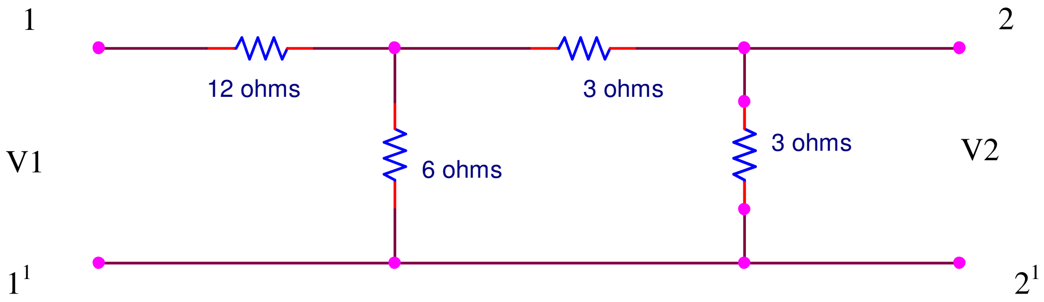


Fig 8b

VTU QUESTION PAPERS

USN

06ES34

Third Semester B.E. Degree Examination, Dec.08/Jan.09

Network Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the node method of analysis. **(04 Marks)**

b. Determine the current through load resistor, R for the network shown in Fig.1(b), using mesh method. **(06 Marks)**

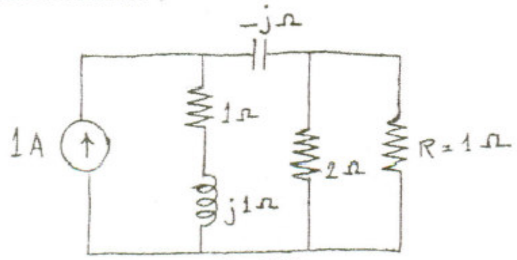


Fig.1(b)

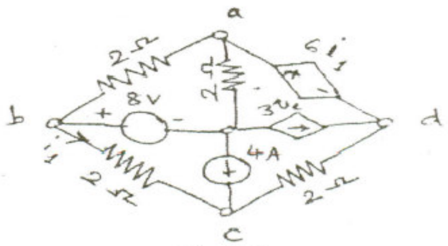


Fig.1(c)

c. For the network shown in Fig.1(c), find the node voltages v_d & v_c. **(10 Marks)**

2 a. Define the following and give one example of each:

(i) Network graph (ii) Tree (iii) Tie set (iv) Cut set. **(06 Marks)**

b. For the circuit diagram shown in Fig.2(b), write the f-cut set matrix & hence obtain the equilibrium equation on node basis & obtain tree branch voltages. Take tree of the graph containing branches (1) & (3) and same orientation as shown in figure. **(14 Marks)**

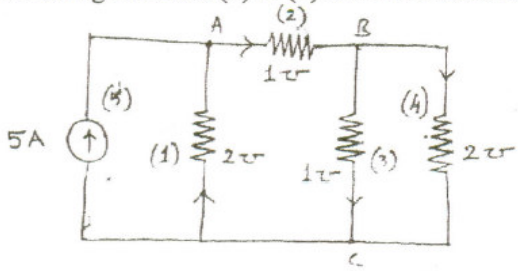


Fig.2(b)

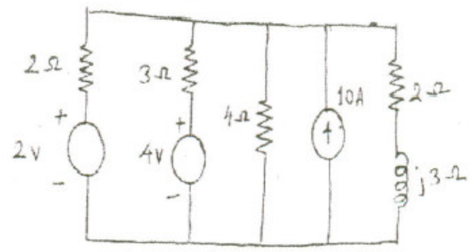


Fig.4(c)

3 a. State the superposition theorem. **(02 Marks)**

b. State and prove the reciprocity theorem. **(06 Marks)**

c. A source of 100V feeds a load impedance Z_L through a series impedance $Z_s = (25 + j40)\Omega$. (i) Determine the load impedance for maximum power transfer & the value of the max. power. (ii) If the load consists of a purely resistance R_L, find the value of R_L for which the maximum power is transferred & max. power transfer. **(12 Marks)**

4 a. State the Norton's theorem. **(02 Marks)**

b. State & prove Thevenin's theorem. **(06 Marks)**

c. Use Millman's theorem to find current flowing through $(2 + j3)\Omega$ impedance, for circuit given in Fig.4(c). **(12 Marks)**

1 of 2

06ES34

PART – B

5 a. Define the following terms: **(04 Marks)**
(i) Resonance (ii) Selectivity (iii) B. W. (iv) Q-factor.

b. Derive the expression for a resonant frequency for a parallel circuit having R in series with L only. **(06 Marks)**

c. Two coils; one of R_1=0.51Ω, L_1= 32mH & other coil of R_2=1.3Ω, L_2= 15mH are in series and are in series with a capacitor of 25 µF & 62 µF and a series resistor of resistance 0.24 Ω. Determine the following:
(i) Resonant frequency (ii) Q-factor of the circuit (iii) B.W.
(iv) Power dissipated in the circuit at resonant frequency **(10 Marks)**

6 a. For the network shown in Fig.6(a), the switch is moved from position 1 to position 2 at t=0 the steady state has been reached before switching. Calculate i, di/dt, d^2i/dt^2 at $t=0^+$ **(10 Marks)**

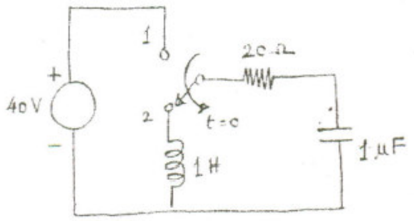


Fig.6(a)

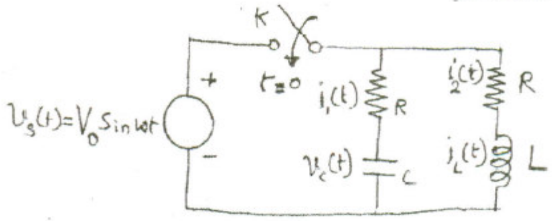


Fig.6(b)

b. For the network shown in Fig.6(b), find out $\frac{di_1(0^+)}{dt}$ & $\frac{di_2(0^+)}{dt}$ when the switch K is closed at t=0. Assume the circuit was not activated before t=0. **(10 Marks)**

7 a. Define the impulse function & obtain its L.T. **(04 Marks)**

b. For a series RL circuit shown in Fig.7(b), the switch K is closed at time t=0, find the current i(t) using Laplace transform. **(06 Marks)**

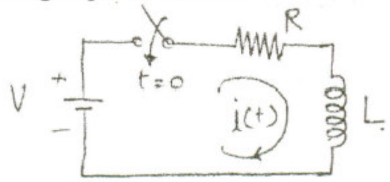


Fig.7(b)

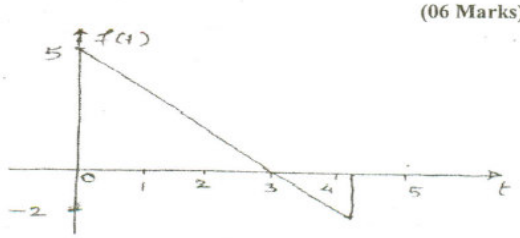


Fig.7(c)

c. Obtain the Laplace transform of F(t) for the waveform shown in Fig.7(c). **(10 Marks)**

8 a. Define Z-parameters. **(04 Marks)**

b. Obtain the relationship between T & h parameters i.e. T parameters in terms of h parameters. **(06 Marks)**

c. Obtain the Y-parameters of the two port network shown in Fig.8(c). **(10 Marks)**

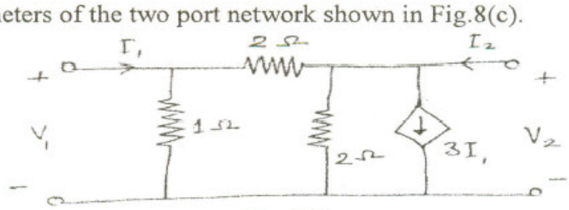


Fig.8(c)

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2 of 2

USN

06ES34

Third Semester B.E. Degree Examination, June-July 2009
Network Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full question, selecting atleast two question from each part.***

Part A

1 a. Three impedances are connected in star. Obtain expressions for their delta connected equivalent. Also find the star equivalent of the following circuit shown in figure Q1 (b). **(09 Marks)**

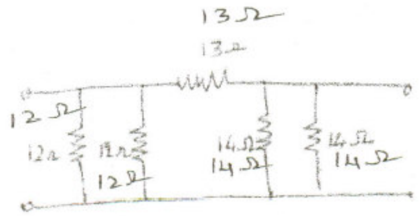

Fig. Q1 (a)

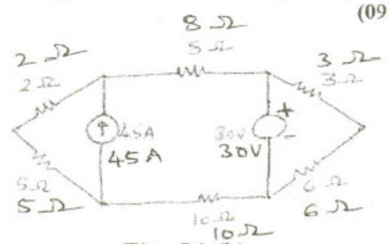

Fig. Q1 (b)

b. Reduce the network shown in figure Q1 (c) to a single voltage source in series with a resistance using source shift and source transformation. **(06 Marks)**

c. Solve for $i_0(t)$ using mesh analysis in the network shown in figure Q1 (c). **(05 Marks)**

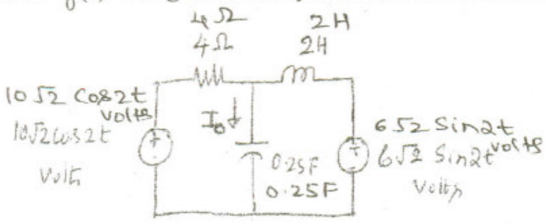

Fig. Q1 (c)

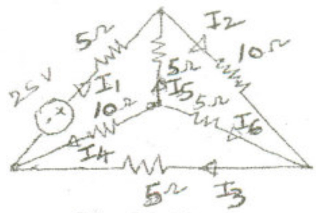

Fig. Q2 (c)

2 a. Define the following terms as applied to network topology with suitable examples,
i) tree and co-tree. ii) Planar and non-planar graphs. **(04 Marks)**

b. The reduced incidence matrix of a graph is given below. Draw the oriented graph corresponding to the same. **(03 Marks)**

$$\begin{bmatrix} -1 & 1 & 0 & 0 & 0 & -1 \\ 0 & -1 & -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & -1 & 1 \end{bmatrix}$$

c. For the network shown in figure Q2 (c), write the tie-set schedule selecting center star as tree and find all branch currents by solving equilibrium equation. **(09 Marks)**

d. Define the term duality as applied to networks. Give suitable example. **(04 Marks)**

3 a. State and explain reciprocity theorem. **(06 Marks)**

b. Find the current through load impedance $Z_L = 15\angle{-30}\Omega$ using Millmans theorem in the circuit shown in figure Q3 (b). **(06 Marks)**

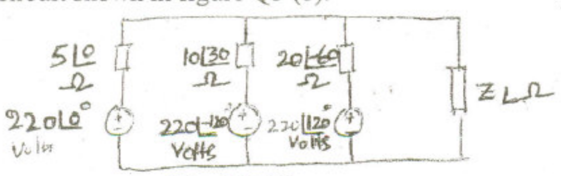

Fig. Q3 (b)

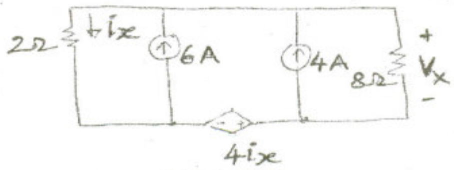

Fig. Q3 (c)

c. Use Superposition theorem to find Vx in the circuit shown in figure Q3 (c). **(08 Marks)**

06ES3N

4 a. State and prove Thevenins theorem. Show that Thevenins equivalent circuit is the dual of Nortons equivalent circuit. (10 Marks)

b. Find the value of R_L for which power transferred to the load is maximum and maximum power. Also establish the condition for maximum power transfer. (10 Marks)

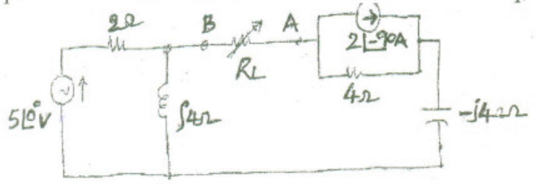

Fig. Q4 (b)

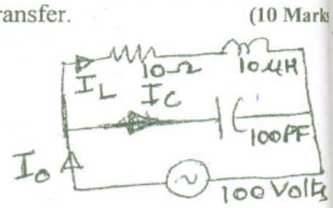

Fig. Q5 (c)

Part B

5 a. Explain the following terms with respect to series resonant circuit i) Selectivity and Band width ii) Q-factor. (05 Marks)

b. In a series resonant circuit, show that resonant frequency is equal to the geometric mean of half power frequencies. (07 Marks)

c. For the parallel resonant circuit shown in figure Q5 (c), find I_O, I_L, I_C, f_O and dynamic resistance. (08 Marks)

6 a. Explain the transient behaviour of the resistance, inductance and capacitance. Also explain the procedure for evaluating transient behaviour. (08 Marks)

b. For the circuit shown in figure Q6 (b), the switch 'K' is changed from position 1 to position 2 at t = 0, steady state condition having been reached in position 1. Find the values of i, $\frac{di}{dt}$ and d^2i/dt^2 at t = 0. (07 Marks)

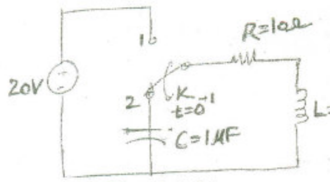

Fig. Q6 (b)

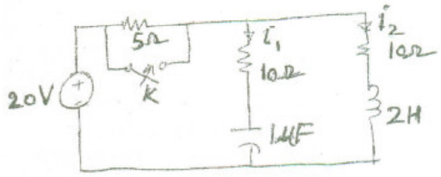

Fig. Q6 (c)

c. In the network shown in figure Q6 (c), the switch 'K' is opened at t = 0 after the network has attained steady state the switch is closed. Find i_1, i_2 at t = 0+ (05 Marks)

7 a. State and prove initial and final value theorem with suitable examples. (08 Marks)

b. Find the Laplace transform of the waveform shown in Fig. Q7 (b). (06 Marks)

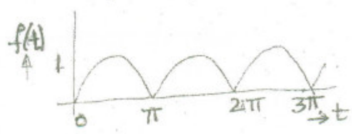

Fig. Q7 (b)

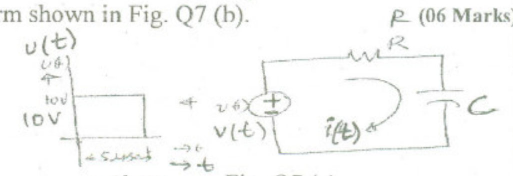

Fig. Q7 (c)

c. A voltage pulse of 10 V magnitude is applied to RC network shown in figure Q7 (c). Find the current i(t) of R = 10 Ω and C = 0.05 μF for the circuit. (06 Marks)

8 a. Express h – parameters in terms of z-parameters and establish the same. (08 Marks)

b. Explain symmetry and reciprocity property of two port networks. (04 Marks)

c. Find the z-parameters of the network shown in figure Q8 (c). (08 Marks)

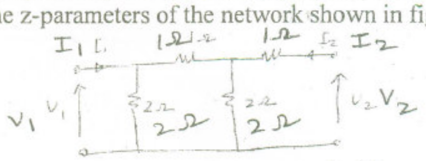

Fig. Q8 (c)

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USN | | | | | | | | | | **06ES34**

Third Semester B.E. Degree Examination, Dec.09/Jan.10

Network Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Write the mesh equations for the circuit shown in Fig.1 and solve for currents i_1, i_2 and i_3. **(10 Marks)**

Fig.1(a)

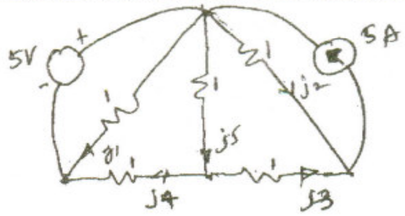
b. The node voltage equations of a network are

$$\left(\frac{1}{5}+\frac{1}{2}j+\frac{1}{4}\right) v_1 - \frac{1}{4} v_2 = \frac{50\angle 0^\circ}{5} \text{ and } -\frac{1}{4} v_1 + \left(\frac{1}{4}-\frac{1}{j2}+\frac{1}{2}\right) v_2 = \frac{50\angle 90^\circ}{2}.$$ Derive the network. **(10 Marks)**

2 a. Define the following terms with respect to the network topology. Give examples.
i) Tree ; ii) Graph ; iii) Sub graph ; iv) Tieset ; v) Cutset. **(08 Marks)**

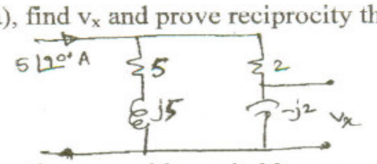
b. For the network shown in Fig.2(b), write the graph and obtain the tieset schedule considering j_1, j_2, j_5 as tree branches. Also calculate all branch currents. **(12 Marks)**

Fig.2(b)



3 a. In the circuit shown in Fig.3(a), find v_x and prove reciprocity theorem. **(10 Marks)**

Fig.3(a)



b. State and explain super position theorem with a suitable example. **(10 Marks)**

4 a. Obtain the Thevenin's equivalent network for the circuit in Fig.4(a) between the terminals X and Y. **(10 Marks)**

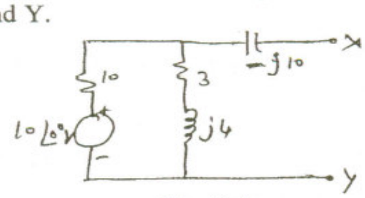


Fig.4(a).

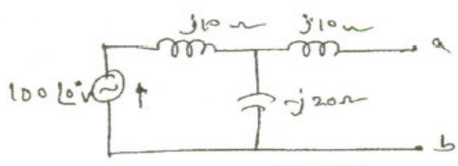


Fig.4(b).

b. What should be the value of pure resistive load to be connected across the terminals a and b in the network shown in Fig. 4(b), so that maximum power is transferred to the load? Calculate the maximum power. **(10 Marks)**

1 of 2

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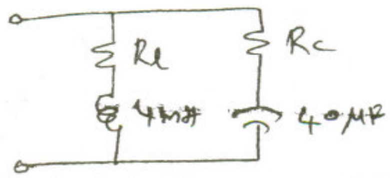
06ES

PART – B

5 a. Show that for a series RLC resonant circuit the selectivity $\varphi = \frac{f0}{f2 - f1}$, whe
fo: resonate frequency f1 and f2 are half power frequency. (08 Mark
b. Determine R_L and R_C for which the circuit shown in Fig.6 resonates at all frequencies. (06 Mark

Fig.5(b)



c. It is required that a series RLC circuit should resonate at 1 MHz. Determine values of R,
and C if bandwidth of the circuit is 5 kHz and its impedance is 50 Ω at resonance. (06 Mark

6 a. Explain the importance of study of initial conditions in electric circuit analysis. (06 Mark
b. Explain the behaviour of R, L and C elements for transients. Mention their representation
the instant of switching. (06 Mark
c. In the circuit shown in Fig.6(c), the switch is moved from 'a' to 'b' at t = 0. Find the value of i, $\frac{di}{dt}, \frac{d^2i}{dt^2}$ at $t = 0^+$, if R = 1 Ω, L = 1 H, C = 0.1 μF and V = 100 V. Assume steady stat is achieved when k is at 'a'. (08 Mark

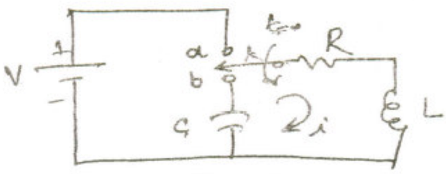


Fig.6(c).

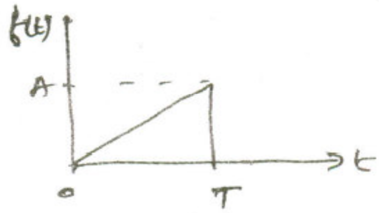


Fig.7(a).

7 a. Obtain the Laplace transform of saw took waveform shown in Fig.7(a). (06 Marks)
b. Find the Laplace transform of i) δ (t) ; ii) t ; iii) e^{-at}. (06 Marks)
c. Find f (o) and f (∞) using initial value and final value theorem for the function given below.

$$F(s) = \frac{s^3 + 7s^2 + 5}{s(s^3 + 3s^2 + 4s + 2)}.$$ (08 Marks)

8 a. Find y parameters for the network shown in Fig.8(a). (08 Marks)

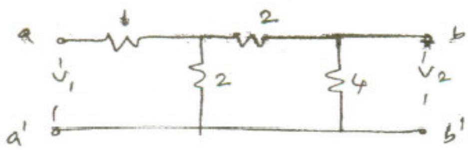


Fig.8(a).

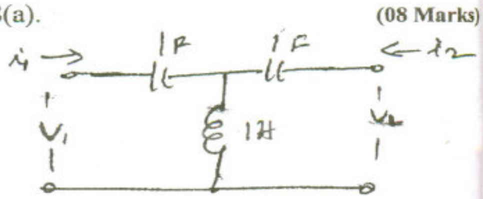


Fig.8(b)

b. Determine the 'h' parameters for the network shown in Fig.8(b). (08 Marks)

c. Mention the application of
i) Transmission parameters ; ii) 'h' parameters ; iii) 'z' parameters. (04 Marks)

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10ES34

USN

Third Semester B.E. Degree Examination, December 2011

Network Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Using the mesh current method, determine V_2 that results zero current in 4Ω resistor.

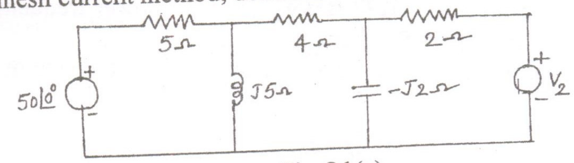

Fig.Q1(a)

(10 Marks)

b. Find the currents in all resistors by Node voltage method. (10 Marks)

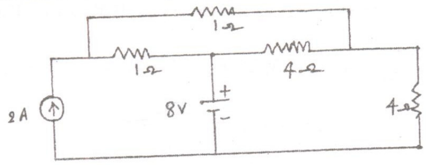

Fig.Q1(b)

2 a. Define the terms : i) Tree, ii) Co-tree, iii) Tie set schedule, iv) Cut set schedule, with respect to a graph of a network. (04 Marks)

b. For the network shown, draw the graph, select a tree, write the tie set schedule and obtain the equilibrium equations. Hence currents in various branches. (16 Marks)

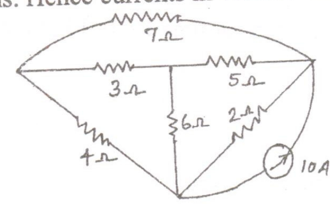

Fig.Q2(b)

3 a. Find the current through Z_3 by superposition theorem. (10 Marks)

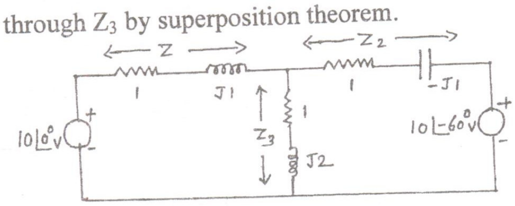

Fig.Q3(a)

b. State and explain reciprocity theorem. (04 Marks)

c. Use Millman's theorem to find current in Z_1 : (06 Marks)

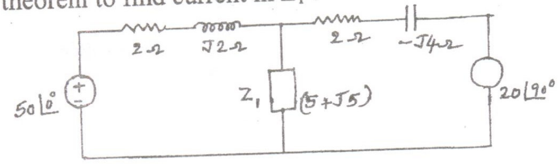

Fig.Q3(c)

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10ES34

4 a. For the circuit shown in Fig.Q4(a), find the value of R that will receive maximum power. Determine this power. **(08 Marks)**

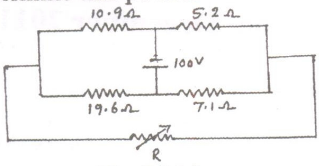

Fig.Q4(a)

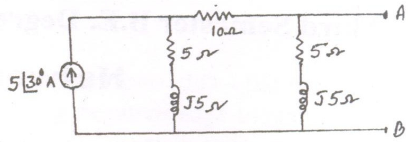

Fig.Q4(b)

b. Obtain the Thevenin and Norton equivalent circuits at terminals AB for the network shown. Hence, find the current through 10Ω resistor across AB. **(12 Marks)**

PART – B

5 a. Define the terms : i) Resonance, ii) Q factor, iii) Half power frequency, iv) Band width, v) Selectivity pertaining to a series RLC circuit. **(05 Marks)**

b. Obtain an expression for the resonance frequency for the circuit shown in Fig.Q5(b).

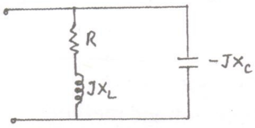

Fig.Q5(b)

(08 Marks)

c. Obtain the condition for maximum value of V_L by variation of inductance. **(07 Marks)**

6 a. In the network shown, switch 'K' is closed at t = 0 with the capacitor uncharged. Find the values for $i(0^+)$ $\frac{di(t)0^+}{dt}$ at $t = 0^+$ and also find $\frac{d^2i(0^+)}{dt^2}$. **(10 Marks)**

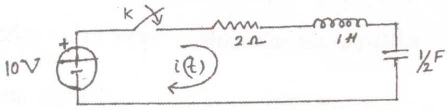

Fig.Q6(a)

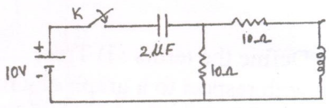

Fig.Q6(b)

b. In the given circuit, switch K is closed at time t = 0. Find the values of i_1, i_2, $\frac{di_1}{dt}$, $\frac{di_2}{dt}$, $\frac{d^2i_1}{dt^2}$, $\frac{d^2i_2}{dt^2}$ at $t = 0^+$. **(10 Marks)**

7 a. Find the Laplace transform of the following :

i) $\sin^2 t$ ii) $\cos^2 t$ iii) sin wt iv) $\int_0^t i(t).dt$ **(08 Marks)**

b. Find the inverse Laplace transform : i) $\frac{s^2+5}{s(s^2+2s+4)}$, ii) $\frac{2s+6}{s^2+6s+25}$. **(08 Marks)**

c. State and prove initial value theorem. **(04 Marks)**

8 a. Express Z parameters in terms of h parameters. **(06 Marks)**

b. For the network shown, find Z and Y parameters. **(14 Marks)**

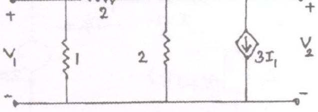

Fig.Q8(b)

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10IT 35 –ELECTRONIC INSTRUMENTATION

SYLLABUS

Sub Code: 10IT35	I.A. Marks: 25
Hours per week: 04	Exam Hours: 03
Total Hours: 52	Exam Marks: 100

Academic Year 2012-13

UNIT – 1: Introduction

(a) Measurement Errors: Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures. (Text 2: 2.1 to 2.3)
(b) Voltmeters and Multimeters Introduction, Multirange voltmeter, Extending voltmeter ranges, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters.

UNIT – 2: Digital Instruments

Digital Voltmeters – Introduction, DVM's based on V – T, V – F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters, Digital measurement of time.

UNIT – 3: Oscilloscopes

Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch

UNIT – 4: Special Oscilloscopes

Delayed time -base oscilloscopes, Analog storage, Sampling and Digital storage oscilloscopes

UNIT – 5: Signal Generators

Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator, Frequency synthesizer

UNIT – 6: Measurement of resistance, inductance and capacitance

Whetstone's bridge, Kelvin Bridge; AC bridges, Capacitance Comparison Bridge, Maxwell's bridge, Wein's bridge, Wagner's earth connection

UNIT – 7: Transducers - I

Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers and LVDT,

UNIT – 8: Miscellaneous Topics

(a) Transducers - II –Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple
(b) Display devices: Digital display system, classification of display, Display devices, LEDs, LCD displays.
(c) Bolometer and RF power measurement using Bolometer
(d) Introduction to Signal conditioning
(e) Introduction to LabView.

TEXT BOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, TMH, 3rd 2010
2. "Electronic Instrumentation and Measurements", David A Bell, PHI / Pearson Education, 2006.

REFERENCE BOOKS:

1. "Principles of measurement systems", John P. Beately, 3rd Edition, Pearson Education, 2000
2. "Modern electronic instrumentation and measuring techniques", Cooper D & A D Helfrick, PHI, 1998.
3. Electronics & electrical measurements, A K Sawhney, , Dhanpat Rai & sons, 9th edition.

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Lesson Plan

Subject: Electronics Instrumentation Subject Code: 10IT 35

Total No. Of Hours – 52

HOUR	TOPICS TO BE COVERED
	1: INTRODUCTION
1	Gross errors and systematic errors
2	Absolute and relative errors, Accuracy, Precision,.
3	Resolution and significant figures
4	Voltmeters and Multimeters
5	Introduction, Multirange voltmeter, Extending voltmeter Ranges
6	Loading, AC voltmeter using Rectifiers
7	Half wave and full wave
8	Peak responding and True RMS voltmeter
	2: DIGITAL INSTUMENTS
9	Digital voltmeters – Introduction
10	on V-T
11	V –F and successive approximation and sensitivity,
12	V –F and successive approximation and sensitivity
13	General specifications
14	Digital Multi-meters
15	Digital measurement Of time.
	3:OSCILLOSCOPES
16	Introduction, Basic principles
17	CRT features
18	Block diagram and working of each block CRO's
19	Typical CRT connections
20	Dual beam and dual trace
21	Electronics switch.
	4: Special Oscilloscopes
22	Delay time base oscilloscope, ,
23	Analog storage
24	sampling and digital storage oscilloscope
25	Sampling and digital storage oscilloscope
26	DSO applications.
	5: Signal Generators
27	Introduction, fixed and variable AF oscillator
28	Standard signal generator,
29	laboratory type signal generator
30	AF sine and square wave generator
31	Function generator
32	Square and pulse generator
33	Sweep frequency generator, frequency synthesizer
	6: Measurement of Resistance, Inductance and capacitance
34	Kelvin bridge,
35	AC bridges
36	Capacitance comparison bridge
37	Maxwell's bridge,
38	Wein's bridge

HOUR	TOPICS TO BE COVERED
39	Wagner's earth connection.
	7: Transducers
40	Introduction, electrical transducers, selecting a transducer
41	Resistive transducer, resistive position transducer, strain gauges,
42	rmometer, thermistor, load cell.
43	Inductive transducer, differential out put transducer and LVDT,
44	Capacitor transducer ,Piezo electric transducer
45	Photoelectric transducer, photovoltaic transducer
46	Semiconductors photo devices
	8: Miscellaneous topics
47	transducers continued –temperature transducer-RTD
48	Thermocouple ,IC type sensors
49	display devices –digital display systems
50	classifications of display
51	Display devices LEDs, LCDs, other displays, Borometer, RF power measurement using borometer
52	Introduction to signal conditioning, Introduction to LabView

QUESTION BANK
ELECTRONIC INSTRUMENTATION-10IT35

Note: answer any five Full questions.

1. **a).** Define dimension of a physical quantity & hence discuss briefly on the significance of the dimensional equations. (06)

   b). By dimensional analysis, determine the indices k,l,m,n of the eqn below for the eddy current loss per meter of wire of circular cross section, where
   w=loss per unit length (weber/meter), f=frequency (cycles/sec.) Bm= max flux density (weber/square meter), ρ=resistivity (Ω-meter) & d=diameter(meter);

   $$w=f^k B_m^l d^m \rho^n$$

   (08)

   c). Explain how a Megger is usefull for measurement of earth/insulation resistance (06)

2. **a).** Derive the balance equation of Kelvin Double Bridge & hence obtain an expression for the unknown low resistance. (08)

   b). In an AC bridge, the arms AB & BC consist of a non inductive resistance of 100 Ω each, the arms BE & CD are of non inductive variable resistances, arm CE is of a condenser of capacitance 1.0 μF & arm AD is of an inductive reactance. The Ac source is fed across the points A & C while the detector is across the points D & E. The bridge is balanced with the resistance in arm CD set at 50 Ω & that in arm BE at 2500 Ω. Determine the resistance & inductance of the arm AD. Derive balance equation & draw vector diagram. (12)

3. **a).** Discuss on the various methods generally adopted for range extension of ammeters & voitmeters. (07)

   b). A moving coil meter makes 15 mA to produce full scale deflection, the potential difference across its terminal being 75 mV. Suggest a suitable scheme for using the instrument as a voltmeter reading 0-100 V & as an ammeter reading 0-50 A. (05)

   c). A PT with a nominal ratio of 2000/100 V, RCF of 0.995 & a phase angle of 22' is used with a CT of nominal ratio of 100/5 A RCF of 1.005 & a phase angle error of 10' to measure the power (Is lead Ip) to a single phase inductive load. The meters connected to these instrument transformers read correct readings of 102 V, 4 A & 375 W. Determine the true values of voltage, current & power supplied to the load. (08)

4. **a).** Write a note on the turns compensation used in instrument transformers. (06)

   b). Describe the construction & working principle of a single phase induction type energy meter. (08)

   c). With a neat figure, explain the measurement of reactive power in 3-phase circuits. (06)

5. **a).** With a support circuit scheme, explain the requirement, significance & procedure of calibration of single phase energy meters. (06)

b). Explain with a neat diagram the construction & working principle of Weston frequency meter. (08)

c). A single phase, 50 A, 230 V, energy meter on full load test makes 61 revolutions in 37 seconds. If the normal disc speed is 520 revolutions per KWH, determine the meter error as a % of true speed. Giving reasons indicate whether the situation is beneficial to the consumer. (06)

6. **a).** Discuss on the different practical methods of connecting the unknown components to the test terminals of a Q-meter. (06)

b). With a neat block diagram, explain the working of a ramp type digital voltmeter. (08)

c). Explain the working & application of multiplier phototube. (06)

7. **a).** Explain the principle of displacement measurements using 2 differential transformers in a closed loop servo system. (08)

b). Write a note on digital to analog multiplexing. (05)

c). Explain the timing relationship of signal in IEEE-488 bus. (07)

8. **a).** Derive an expression for the critical angle for achieving total internal reflection in a fiber optic transmission system. (08)

b). Write a note on the sources & detectors used for fiber optic measurements. (06)

c). Briefly explain about the instrument used in computer controlled instrument (06)

VTU QUESTION PAPERS

USN | | | | | | | | | | 06IT35

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08

Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

Note : *Answer any FIVE full questions.*

1 a. Define the following terms as applied to an electronic instrument:
i) Accuracy ii) Precision iii) Resolution. **(06 Marks)**
b. Explain the working of a true RMS voltmeter with the help of a suitable block diagram. **(08 Marks)**
c. Determine the value of the multiplier resistance on the 50 V range of a dc voltmeter, that uses a 250 μA meter movement with an internal resistance of 100 Ω. **(06 Marks)**

2 a. Discuss the advantages of a digital voltmeter over an analog voltmeter. **(04 Marks)**
b. Explain the working of a digital frequency meter with the help of a block diagram. **(10 Marks)**
c. Determine the resolution of a 3½ digit display on 1 V and 10 V ranges. **(06 Marks)**

3 a. Draw the basic block diagram of an oscilloscope. Explain the functions of each block. **(08 Marks)**
b. Describe the following modes of operation available in a dual trace oscilloscope:
i) ALTERNATE mode ii) CHOP mode. **(06 Marks)**
c. Explain the operation of an electronic switch with the help of a block diagram. **(06 Marks)**

4 a. Explain why time delay is necessary in oscilloscopes. **(04 Marks)**
b. Explain the operation of a digital storage oscilloscope with the help of a block diagram. Mention the advantages. **(10 Marks)**
c. Write an explanatory note on sampling oscilloscopes. **(06 Marks)**

5 a. Explain the operation of a conventional standard signal generator with the help of a block diagram. Mention the applications. **(08 Marks)**
b. Explain the operating principle of a function generator with the help of a block diagram. **(08 Marks)**
c. Describe briefly any one application of sweep frequency generator. **(04 Marks)**

6 a. A highly sensitive galvanometer can detect a current as low as 0.1 nA. This galvanometer is used in a Wheatstone Bridge as a detector. Each arm of the bridge has a resistance of 1 kΩ. The input voltage applied to the bridge is 20 V. Calculate the smallest change in resistance, which can be detected assuming the resistance of the galvanometer is negligible. **(06 Marks)**
b. Explain the operation of the Wien's Bridge with a neat circuit diagram. Derive the expression for the frequency. **(08 Marks)**
c. Write a note on Wagner's earth connection. **(06 Marks)**

7 a. Distinguish between active and passive transducers with an example. **(04 Marks)**
b. A 120 Ω strain gage with a gage factor of 2 is affixed to a metal bar. The bar is stretched and this causes a change in resistance of 0.001 Ω. Find the change in length if the original length was 10 cm. **(06 Marks)**
c. Describe the different types of thermistor. **(04 Marks)**
d. Explain the working principle of a photo cell with an application. **(06 Marks)**

8 a. Compare LED and LCD types of displays. **(06 Marks)**
b. Explain how power is measured using a bolometer, with a suitable diagram. **(08 Marks)**
c. Write a short note on signal conditioning system. **(06 Marks)**

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USN

06IT35

Third Semester B.E. Degree Examination, June / July 08
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

Note : ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Assume any missing data.

PART A

1 a. Explain the following with example: i) Gross Errors ii) Systematic Errors iii) Random Errors iv) Absolute Errors and v) Relative Errors. **(10 Marks)**

b. Find the voltage reading and % Error of each reading obtained with a voltmeter on i) 5 V range ii) 10 V range and iii) 30 V range, if the instrument has a 20 kΩ/V sensitivity and is connected across R_b. Comment upon the results. **(10 Marks)**

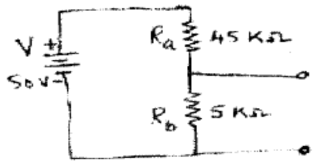

Fig.Q1(b)

2 a. With block diagram explain the principle and operation of successive approximation type DVM. Show transition diagram for 3 bit. **(10 Marks)**

b. With schematic explain the principle and operation of digital frequency meter. **(10 Marks)**

3 a. Write typical CRT connection details and explain different control knobs on the front panel of the CRO. **(10 Marks)**

b. What is the difference between Dual beam and Dual trace CRO? **(05 Marks)**

c. An electrically deflected CRT has a final anode voltage of 2000 V and parallel deflecting plates 1.5 cm long and 5 mm apart. If the screen is 50 cm from the center of deflecting plates, find: i) Beam speed, ii) The deflection sensitivity of the tube and iii) The deflection factor of the tube. **(05 Marks)**

4 a. Explain the principle and operation of sampling oscilloscope. What are its advantages and disadvantages? **(10 Marks)**

b. With block diagrams explain the principle and operation of digital storage oscilloscope. Also explain how to overcome the limitations of this oscilloscope using high performance converter. **(10 Marks)**

PART B

5 a. With block diagram explain conventional standard signal generator. **(10 Marks)**

b. Explain with a block diagram AF Sine-Square wave audio oscillator with different knobs on the front panel. **(10 Marks)**

6 a. What are the limitations of Wheatstone's Bridge? Derive the balance equation of Kelvin's Double Bridge for unknown low resistance. **(10 Marks)**

b. Four arms of an AC bridge are as follows: AB = a pure capacitance of 0.2 μF, BC = 500 Ω pure resistance, CD = unknown series circuit impedance, DA = 0.1 μF capacitance in parallel with 300 Ω resistance. Arm BD is connected with a detector and 5 V, 1000 Hz supply is connected across AC. Find unknown components value which are in series in branch CD at bridge balance condition. Write circuit diagram. **(10 Marks)**

7 a. What are the factors to be considered for the selection of better transducer? Explain. **(10 Marks)**

b. Explain the construction, principle and operation of LVDT. Show characteristic curves. How is the direction of motion determined? **(10 Marks)**

8 a. What are the different types of photoelectric transducers? Explain any two. **(10 Marks)**

b. Explain the principle of LED and RTD. Comment on their characteristics. **(10 Marks)**

USN 1PE07EC048 06IT35

Third Semester B.E. Degree Examination, Dec.08/Jan.09

Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions selecting at least two questions from each part.***

Part A

1 a. Explain the following in brief:
i) Accuracy and precision.
ii) Resolution.
iii) Grass error. **(06 Marks)**

b. With relevant expressions explain the working of practical multirange voltmeter. **(06 Marks)**

c. A basic D'Arsonoral movement with an internal resistance of 50 Ω and a full scale deflection current of 2 mA is to be used as a multirange voltmeter. Design a series string of multipliers to obtain the voltage ranges of 0 – 10 V, 0 – 50 V, 0 – 100 V, 0 – 500 V. **(08 Marks)**

2 a. Describe in detail working of successive approximation DVM. **(10 Marks)**

b. With a block schematic explain the working of digital multimeter. **(10 Marks)**

3 a. Describe the working of basic CRO with the block diagram. **(08 Marks)**

b. Explain what are Lissagous pattern. In the CRO the horizontal signal is designated as f_h and vertical signal as f_v, with reference to this explain in brief the various Lissajous patterns for,

i) $f_v = f_h$ ii) $f_v = 2f_h$ iii) $f_v = 3f_h$ iv) $f_v = 4f_h$ v) $f_v = 5f_h$

vi) $f_v = \frac{1}{2}f_h$ vii) $f_v = \frac{1}{3}f_h$ viii) $f_v = \frac{1}{4}f_h$ ix) $f_v = \frac{1}{5}f_h$ **(12 Marks)**

4 a. With a block diagram explain construction and working of digital storage oscilloscope. **(10 Marks)**

b. With relevant block diagrams and waveforms explain the working of sampling oscilloscope. **(10 Marks)**

Part B

5 a. Explain the working of AF sine and square wave generator. **(10 Marks)**

b. With a block diagram, explain the working of pulse generator. **(10 Marks)**

6 a. A wheatstone's bridge shown with corresponding resistances. The battery voltage is 5V and its internal resistance is negligible. The galvanometer used is of sensitivity 5 mm/μA and an internal resistance of 200 Ω. Determine the deflection of galvanometer caused by 2 Ω unbalance in arm AD. Also determine the sensitivity of the bridge in terms of deflection per unit change in resistance. **(08 Marks)**

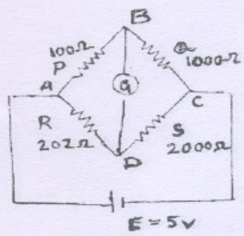

Fig. Q6 (a)

06IT35

6 b. An AC bridge with terminals A, B, C, D (consecutively marked) has in arm AB a pure resistance. Arm BC has a resistance of 800 Ω in parallel with a capacitor of 0.5 μF, arm CD has a resistance of 400 Ω in series with a capacitor of 1.0 μF. Arm DA has a resistance of 1000 Ω,

i) Obtain the value of the frequency for which the bridge can be balanced by first deriving the balance equations connecting the branch impedance and

ii) Calculate the value of the resistance in arm AB to produce balance. **(12 Marks)**

7 a. With a neat sketch explain construction and working of LVDT. **(08 Marks)**

b. What is gauge factor? Derive appropriate relation for the same. **(06 Marks)**

c. A platinum temperature transducer has a resistance of 100 Ω at 25°C,

i) Find its resistance at 75°C if the platinum has a temperature coefficient of 0.00392/°C.

ii) If the platinum temperature transducer has a resistance of 200 Ω. Calculate the temperature. Use linear approximation. **(06 Marks)**

8 a. With a neat sketch explain construction and working of platinum RTD. **(10 Marks)**

b. Describe the working of optical pyrometer. Mention its merits and demerits. **(10 Marks)**

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USN

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Explain the following:
i) Systematic errors ii) Relative errors. (04 Marks)

b. Explain the working principle of multi-range voltmeter, with the help of suitable circuit diagram. (08 Marks)

c. Convert a basic meter movement with an internal resistance of 50 Ω and a full scale deflection current of 2 mA in to a multi-range 'dc' voltmeter with voltage ranges of 0-10V, 0-50V, 0-100V and 0-250V with following Fig.1(c). (08 Marks)

Fig.1(c).

2 a. Explain the ramp type digital voltmeter with the help of block diagram. (10 Marks)

b. Explain the digital multimeter with basic circuit diagram. (10 Marks)

3 a. Explain the C.R.T. features briefly. (06 Marks)

b. With the basic block diagram, explain the principle of operation of simple C.R.O. (08 Marks)

c. Explain the operation of an electronic switch, with the help of a block diagram. (06 Marks)

4 a. Explain the principle and operation of sampling oscilloscope. What are its advantages and disadvantages? (10 Marks)

b. Explain the operation of digital storage-oscilloscope with the help of a block diagram. Mention the advantages. (10 Marks)

PART – B

5 a. With a block diagram, explain modern laboratory signal generator. (10 Marks)

b. Sketch the circuit and waveforms for an OP-AMP astable multivibrator for use as a square wave generator. Explain its operation. (10 Marks)

6 a. Explain the Wheatstone bridge and derive the balance equation for Wheatstone bridge. (06 Marks)

b. Explain AC bridge and derive the balance equation for capacitance comparison bridge. (08 Marks)

c. Find the equivalent parallel resistance and capacitance that causes a wein bridge to null with the following components values:
$R_1 = 3.1\ k\Omega$, $c_1 = 5.2\mu F$, $R_2 = 25\ k\Omega$, $f = 2.5kHz$ and $R_4 = 100k\Omega$ (06 Marks)

7 a. Explain the potentiometer with figure. (06 Marks)

b. Explain the resistance thermometer with circuit diagram. (06 Marks)

c. Explain the construction, principle and operation of LVDT. Show characteristics curve. (08 Marks)

8 a. Explain piezo electrical transducer, with circuit diagram. (06 Marks)

b. Explain the light emitting diodes (LED) with diagram. (06 Marks)

c. Explain how power is measured using a bolometer, with a suitable diagram. (08 Marks)

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2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

USN

10IT35

Third Semester B.E. Degree Examination, December 2011
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the following in brief : **(08 Marks)**
i) Gross errors ; ii) Relative errors ; iii) Accuracy ; iv) Resolution.
b. Explain the working of a true RMS voltmeter with the help of a suitable block diagram. **(08 Marks)**
c. Define sensitivity. Determine the value of the multiplier resistance on the 50V range of a dc voltmeter that uses a 250 μA meter movement with an internal resistance of 100Ω. **(04 Marks)**

2 a. Explain the ramp type digital voltmeter with the help of a block diagram. **(10 Marks)**
b. With block diagram, explain the principle and operation of digital frequency meter. **(10 Marks)**

3 a. Explain the CRT features briefly. **(05 Marks)**
b. Draw the basic block diagram of an oscilloscope. Explain the functions of each block. **(10 Marks)**
c. Describe the following modes of operation available in a dual trace oscilloscope : **(05 Marks)**
i) ALTERNATE mode ; ii) CHOP mode.

4 a. Explain why time delay is necessary in oscilloscopes. **(04 Marks)**
b. Explain the principle and operation of sampling oscilloscope with relevant block diagrams. **(08 Marks)**
c. Explain the operation of digital storage oscilloscope with the help of a block diagram. Mention the advantages. **(08 Marks)**

PART – B

5 a. With block diagram, explain conventional standard signal generator. Mention the applications. **(10 Marks)**
b. Explain the operation of a function generator with the help of a block diagram. **(10 Marks)**

6 a. Explain the Wheatstone bridge and derive the balance equation for Wheatstone bridge. Mention the limitations. **(08 Marks)**
b. Find the equivalent parallel resistance and capacitance that causes a wein bridge to null with the following component values :
$R_1 = 3.1\ k\Omega$, $C_1 = 5.2\ \mu F$, $R_2 = 25\ k\Omega$, $f = 2.5$ kHz and $R_4 = 100\ k\Omega$. **(06 Marks)**
c. Write a note on Wagner's earth connection. **(06 Marks)**

7 a. What are the factors to be considered for the selection of better transducer? Explain. **(08 Marks)**
b. Explain the construction, principle and operation of LVDT. **(12 Marks)**

8 a. Explain piezo electric transducer, with circuit diagram. **(08 Marks)**
b. Compare LED and LCD types of displays. **(06 Marks)**
c. Write a short note on signal conditioning system. **(06 Marks)**

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10ES36– FIELD THEORY

SYLLABUS
FIELD THEORY

Sub Code: 10ES36 | I.A. Marks: 25
Hours per week: 04 | Exam Hours: 03
Total Hours: 52 | Exam Marks: 100

UNIT 1:
a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge
b. **Electric flux density, Gauss' law and divergence:** Electric flux density, Gauss' law, Divergence, Maxwell's First equation(Electrostatics), vector operator **Ñ** and divergence theorem

UNIT 2:
a. **Energy and potential :** Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient , Energy density in an electrostatic field
b. Conductors, dielectrics and capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics, capacitance and examp les.

UNIT 3:
Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations

UNIT 4:
The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials

UNIT 5:
a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance.

UNIT 6:
Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

UNIT 7:
Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors – (skin effect).

UNIT 8:

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions.

TEXT BOOK:

"Engineering Electromagnetics", William H Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th edition, 2006

REFERENCE BOOKS:

1. "Electromagnetics with Applications", John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999
2. "Electromagnetic Waves And Radiating Systems," Edward C. Jordan and Keith G Balmain, Prentice – Hall of India / Pearson Education, 2nd edition, 1968.Reprint 2002
3. "Field and Wave Electromagnetics", David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

LESSON PLAN

Subject: – FIELD THEORY	**SUB CODE:10ES36**
Total Hours: 52	

Hours	Topics to be covered
01	Introduction to electric fields. Fundamental relation of electrostatic field, Coulombs law.
02	Electric field intensity, Experiment law of coulomb, Relation between Electric field intensity & Electric field, Field due to Point charge.
03	Electric field intensity, Experiment law of coulomb, Relation between Electric field intensity & Electric field, Field due to Point charge.
04	Field due to continuous volume charge, line charge and sheet charge. Simple problems relating electric field, electric field intensity.
05	Electric flux density, Relation between vector D&E and Gauss law.
06	Application of Gauss law Field at a point due to an infinite line charge of uniform liner charge density, Field at a point due to a spherical shell of charge.
07	Vector operator v, Divergence and Gauss divergence theorem.
08	Energy and potential, Expression for energy expended in moving a point charge in an electric field. Problems on the same.
9	Definition of potential difference and potential
10	Expression for Electrostatic potential due to point and a system of charges.
11	Expression for potential gradient and energy density in an electric field.
12	Solving problems on potential gradient and energy density.
13	Definition for current and Current density and deriving expression for the same. Problems on current density.
14	Obtaining an expression for continuity of current and definition for metallic conductors.
15	Conductor properties and boundary conditions.
16	Boundary conditions for perfect dielectrics, capacitance and examples.
17	Poisson and Laplace's Equations
18	Uniqueness theorem.
19	Examples of the solutions of Laplace's and Poisson's equations.
20	Introduction to magnetostatics and Biot-Savart law.
21	Amperes law, proof of Amperes circuital law.
22	Solving problems based on Amperes circuital law.
23	Curl, Stoke's Theorem. Problems on the same.
24	Definition for magnetic flux and flux density.
25	Scalar and Vector magnetic potential
26	Problems on flux and flux density, scalar and vector magnetic potential.
27	Force on a moving charge and differential current element.
28	Force between differential current elements.
29	Force and torque on a closed circuit.
30	Magnetization and permeability
31	Magnetic boundary conditions, magnetic circuit
32	Energy & forces on magnetic materials, self-inductance.
33	Solving problems based on Magnetostatics.

34	**Faraday's law and displacement current.**
35	Maxwell's Equation: Modification of the Static field equation for time varying fields
36	Maxwell's equation in differential form.
37	Maxwell's equation in Integral form and word statement form, retarded potential.
38	Problems on Maxwell's equation.
39	Introduction to electromagnetic waves and wave propagation
40	Electric and Magnetic wave equation
41	Defining Uniform plane waves. Relation between E and H for a uniform plane wave.
42	Solution of wave equation for a uniform wave in (a) Conducting medium & (b) in low –loss dielectric.
43	Solution of wave equation for a uniform wave in perfect dielectric
44	Wave propagation in free space and dielectrics.
45	Introduction to Poynting vector and Power flow. Power considerations.
46	Propagation in good conductors (skin effect), wave polarization.
47	Derivation of propagation constant, attenuation constant, phase velocity and wavelength.
48	Reflection of uniform plane waves at the surface of the conductors and dielectrics-Brewster angle
49	Reflection of uniform plane waves in dispersive media.
50	Reflection of uniform plane waves at normal incidence, SWR.
51	Reflection of uniform plane waves at oblique incidence, Brewster's angle.
52	Problems on uniform plane waves and polarization. Problems on pointing vector and power flow.

QUESTION BANK

FIELD THEORY-10ES36

1. **a.** Find the expression of the field component at a far point due to a dipole. **06**

b. Find the far field for the linear quadruple having three charges along Z-axis.2q at Z=0,-q at Z=a and q at Z=a. 07

c. $E= 10 \dfrac{[xa_x+ya_y]-2a_z}{x^2+y^2}$ V/m

Potential at (3,4,5) is 10 volt. Find V at (6, -8, 7). **07**

2. **a.** State and prove Gauss's law and determine the field due to an infinite line charge using this. **10**

b. A spherical volume charge density is given by $\rho= \rho_o (1-r^2 /a^2)$ r≤a r>a

i. Calculate the total charge Q

ii. Find the electric field intensity E outside the charge distribution

iii. Find the electric field intensity for r ≤a.

iv. Show that the maximum value of E is at r= 0.745a **10**

3. **a.** Derive Expressions for energy and energy density in a capacitor **06**

b. Show that the capacitance between two identical spheres of radius R separated by a distance (d >>R) is given by $4\pi\varepsilon_o$ dR/ 2(d-R) **08**

c. Derive the expression for the magnetic flux density at a point due to an infinitely long current carrying conductor. **06**

4. **a.** State and explain the Amperes circuit law. Apply the law to determine the magnetic field inside and outside a conductor of radius 'a'. The conductor carries a current of 'I' amperes. Sketch the fields. **06**

b. Determine the magnetic vector potential near a long conductor 0f carrying steady current. **06**

c. Calculate the displacement current when AC voltage of 100sin ($2\pi 10^4 t$) is applied across a capacitor of 4 microfarad at instances0.01ms, 1.0ms. **08**

5. **a.** How many turns are required for a square loop of 100 mm on a side to develop a maximum emf of 10 mv RMS if the loop rotates at 30 r/s in earth's magnetic field? Take B = 60 micro sec **10**

b. Show that the line integral of magnetic vector potential vector A over a closed loop gives the magnetic flux passing through the area bounded by the loop. **10**

6. **a.** Prove wave propagation in a general medium & arrive at wave propagation in a good conducing medium. **10**

b. Determine Attenuation constant, Phase shift constant, Phase velocity & intrinsic impedance of the medium **10**

7. **a.** State and prove Poynting theorem. **08**

b. Prove wave propagation in a general medium & arrive at wave propagation in a good conducting medium. **12**

8. a. Explain polarization of plane waves. Write different types of polarization of plane wave. **10**

b. Define wave & uniform plane wave W.R.T Circular & Elliptical polarization of electric field. **10**

9. a. What is Equi-potential surface? Give two examples of such surfaces. **10**

b. Derive an expression for skin depth. Give an example for it. **10**

10. Write short note on **(5Marks each)**

i. Wave Propagation in a good conducting medium
ii. Brewster angle
iii. Linear polarization
iv. Boundary condition between two dielectrics

QUESTION BANK(Contd)-Part-II

1. **(a)** Define the following.

i) Electric field intensity.
ii) Electric scalar potential. **(4 marks)**

(b) Volume charge density is located in free space as ρv=2e^-1000r nc/m^3 for 0< r< 1mm, and ρv = 0 elsewhere.

i) Find the total charge enclosed by the spherical surface r = 1mm.
ii) By using Gauss's law, calculate the value of Dr on the surface r = 1mm. **(10 marks)**

(c) Derive an expression for the relationship between electric field intensity, E and electric scalar potential, V. **(6 marks)**

2. **(a)** Calculate the divergence of D at the point specified if

(i) D=1/z2[10xyzax +5x2zay +(2z3-5x2y)az] at P[-2,3,5]
(ii) D=5z2ap+10ρzaz at P [3, -45,5]
(iii) D=2rsinθ sinΦ ar+rcosθ sinΦ aθ +r cosΦ aΦ at P [3,45, -45] **(9 marks)**

(b) Derive an expression for Gauss Law in differential form. **(5 marks)**

(c) Discuss the boundary conditions on E and D at the boundary between two dielectrics. **(6 marks)**

3. **(a)** Given the potential field V=[Ap4 + Bp-4] sin4 ρ

(i) Show that
(ii) Select A and B so that V=100 volts and |E|=500V/m at P(ρ=1,Φ=22.5 ,z=2) **(10 marks)**

(b) Show that the energy density in an electrostatic field is given by ω=1/2εE2 J/m3 **(6 marks)**

(c) Explain Biot-Savart law. **(4 marks)**

4 **(a)** Show that in a parallel plate capacitor subjected to a time –changing field, the displacement current in the dielectric must be equal to conduction current in the wire. **(6 marks)**

(b) Show that J=δ ρ v/ δt where ρv=volume charge density in c/m3. **(6 marks)**

(c) Given the field H=20ρ2 aΦ A/m.

(i) Determine the current density J.
(ii) Integrate J over the circular surface ρ=1,0<Φ<2π, z=0, to determine the total current passing through that surface in the az direction. **(8 marks)**

5. **(a)** Show that the line integral of magnetic vector potential around a closed path must be equal to the flux passing through the area bounded by the closed path. **(6 marks)**

(b) Derive an expression for Maxwell's Equation in vector differential form for time changing fields, starting from Faraday-Lenz's law. **(7marks)**

(c) Assume A=50ρ2az ωb/m in a certain region of free space. Find H and B. **(7 marks)**

6. **(a)** Discuss the wave propagation of a uniform plane wave in the following:

(i) Good dielectric medium.

(ii) Good conducting medium.

(b) Wet, marshy soil is characterized by σ=10^-2 s/m, εr=15, and μr=1. At the frequencies 60Hz, 1MHz, 100MHz and 10 GHz, indicate whether the soil may be considered a conductor, a dielectric or neither. **(10 marks)**

7. **(a)** State and prove Poynting's Theorem . **(10 marks)**

(b) Show that a uniform plane wave propagating in free space is transverse in nature. **(6 marks)**

(c) Show that the wave impedance of free space is Zo=377Ω. **(4 marks)**

8. Write short notes on the following:

(i) Brewster angle.

(ii) Ampere's circuit law.

(iii) Gauss law.

(iv) Linear and Circular polarization.

(5*4=20 marks)

VTU QUESTION PAPERS

USN | | | | | | | | | | 06ES36

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08

Field Theory

Time: 3 hrs. Max. Marks:100

Note : 1. *Answer any FIVE full questions.*
2. *Assume any missing data suitably.*

1 a. State and explain Gauss Law. Find out the relation between D and E. **(06 Marks)**

b. Charge is distributed uniformly along an infinite straight line with constant density ρ_l. Develop the expression for E at the general point P. **(06 Marks)**

c. A vector field is given by, $A(r,\phi,z) = 30e^{-r} a_r - 2za_z$. Verify the divergence theorem for the volume enclosed by, $r = 2$, $z = 5$. **(08 Marks)**

2 a. If $E = -8xya_x - 4x^2 a_y + a_z (V/m)$. Find the work done in carrying a 6 coulomb charge from A(1, 8, 5) to B(2, 18, 6) along the path $y = 3x+2$, $z = x+4$. **(08 Marks)**

b. A potential function is $v = 2x+4y$ volts, is in free space. Find the stored energy in free space in the 1 m^3 volume centered at origin. **(06 Marks)**

c. Starting with principle of charge conservation, obtain point form of continuity equation. **(06 Marks)**

3 a. Obtain the conditions on the tangential and normal components of electric field intensity and electric flux density at the boundary between two dielectric media. **(08 Marks)**

b. Derive Poisson's and Laplace's equations starting from point form of Gauss law. **(06 Marks)**

c. State and explain uniqueness theorem. **(06 Marks)**

4 a. Find H at the centre of a square current loop of side 4 meters, if a current of 5 amp is passing through it. **(08 Marks)**

b. State and explain Ampere's circuit law. **(06 Marks)**

c. Given $A = (y\cos ax)a_x + (y+e^x)a_z$, find $\nabla \times A$ at the origin. **(06 Marks)**

5 a. Derive Lorentz force equation and mention the application of its solution. **(06 Marks)**

b. Define torque. Find the torque about the z-axis for a conductor located at $x = 0.4$ m, $y = 0$ and $0 < z < 2$m, which carries a current of 5A in the a_z direction, along the length of the conductor. $B = 2.5a_z$ Tesla. **(06 Marks)**

c. Derive the expression for the inductance of a toroidial ring with N turns and carrying current I amp. Assume the radius of the toroid be 'R' m and area of cross section of toroidial ring be 'A' m^2. **(08 Marks)**

6 a. State and explain Faraday's law for EMF when a closed conductor single loop circuit is placed in time varying magnetic field and hence show that $\nabla \times E = -\partial B/\partial t$. **(07 Marks)**

b. Write Maxwell's equations for free space in point and integral forms. **(08 Marks)**

c. Write a short note on retarded potentials. **(05 Marks)**

7 a. What is uniform plane wave? Explain its propagation in free space with necessary equations. **(08 Marks)**

b. What is loss tangent? Explain its practical importance. **(06 Marks)**

c. Find the skin depth δ at a frequency of 1.6 MHz in aluminium, where σ = 38.2 MS/m and $\mu_r = 1$. Also find γ, λ and V_P. **(06 Marks)**

8 a. Define the terms i) Reflection co-efficient and ii) Transmission co-efficient. Also bring out the relation between them. **(08 Marks)**

b. Write a short note on SWR. **(05 Marks)**

c. A 50 MHz uniform plane wave has electric field amplitude 10 V/m. The medium is lossless, having $\epsilon_r = 9$ and $\mu_r = 1$. The wave propagates in the x, y plane at a 30° angle to the x axis and is linearly polarized along z. Write down the phasor expression for the electric field. Also find λ_x, λ_y, V_{px} and V_{py}. **(07 Marks)**

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Third Semester B.E. Degree Examination, June / July 08
Field Theory

Time: 3 hrs. Max. Marks:100

Note : ***Answer FIVE full questions, selecting atleast two question from each part.***

PART - A

1 a. State and explain Coulomb's law in vector form. **(04 Marks)**

b. Two point charges of magnitudes 2 mc and –7 mc are located at places $P_1(4, 7, -5)$, and $P_2(-3, 2, -9)$ respectively in free space, evaluate the vector force on charge at P_2. **(06 Marks)**

c. From Gauss Law show that $\nabla.\hat{D} = \rho_v$. **(10 Marks)**

2 a. Find the potentials at $\gamma_A = 5\text{m}$ and $\gamma_B = 15\text{m}$ due to a point charge Q = 500 pc placed at the origin. Find the potential at $\gamma_A = 5\text{m}$ assuming zero as potential at infinity. Also obtain the potential difference between points A and B. **(06 Marks)**

b. Derive an expression for the potential of co-axial cable in the dielectric space between inner and outer conductors. **(06 Marks)**

c. Discuss the boundary conditions between two perfect dielectrics. **(08 Marks)**

3 a. State and prove uniqueness theorem. **(08 Marks)**

b. From the Gauss's law obtain Poisson's and Laplace's equation. **(06 Marks)**

c. Determine whether or not the following potential fields satisfy Laplace's equation –

i) $V = x^2 - y^2 + z^2$, ii) $V = r\cos\phi + z$. **(06 Marks)**

4 a. Using Biot – Savart law find an expression for the magnetic field of a straight filamentary conductor carrying current 'I' in the Z – direction. **(08 Marks)**

b. Given the magnetic field $H = 2r^2(Z+1)\sin\phi\hat{a}_\phi$, verify Stokes theorem for the portion of a cylindrical surface defined by $r = 2$, $\frac{\pi}{4} < \phi < \pi/2$, $1 < Z < 1.5$ and for its perimeter. **(08 Marks)**

c. With necessary expressions, explain scalar magnetic potential. **(04 Marks)**

PART - B

5 a. Find the expression for the force on a differential current carrying elements. **(06 Marks)**

b. Find the normal component of the magnetic field which traverses from medium 1 to medium 2 having $\mu_{r_1} = 2.5$ and $\mu_{r_2} = 4$. Given that $\hat{H} = -30\hat{a}_x + 50\hat{a}_y + 70\hat{a}_z$ v/m. **(06 Marks)**

c. Derive an expression for the self inductance of a co – axial cable. **(08 Marks)**

6 a. For a closed stationary path in space linked with a changing magnetic field prove that $\nabla\times\hat{E} = \frac{-\partial\hat{B}}{\partial t}$, where $\hat{E}$ is the electric field and $\hat{B}$ is the magnetic flux density. **(08 Marks)**

b. Determine the frequency at which conduction current density and displacement current density are equal in a medium with $a = 2\times10^{-4}$ s/m and $\epsilon_r = 81$. **(04 Marks)**

c. List the Maxwell's equations in differential and integral form as applied to time varying fields. **(08 Marks)**

7 a. Starting from Maxwell's equation, derive the wave equation for a uniform plane wave traveling in free space. **(08 Marks)**

b. A 300 MHz uniform plane wave propagates through fresh water for which $\alpha = 0$, $\mu_r = 1$ $\epsilon_r = 78$. Calculate i) attenuation constant ii) phase constant iii) wave length iv) intrinsic impedance. **(06 Marks)**

c. Explain the skin depth. Determine the skin depth for copper with conductivity of 58×10^6 s/m at a frequency of 10 MHz. **(06 Marks)**

8 a. Show that at any instant t, the magnetic and electric field in a reflected wave are out of phase by 90^0. **(10 Marks)**

b. With necessary expression, explain standing wave ratio (SWR). **(10 Marks)**

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Third Semester B.E. Degree Examination, Dec.08/Jan.09

Field Theory

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions by choosing at least Two from each part*
2. Any missing data can be assumed.
3. Draw neat diagram wherever necessary.

PART - A

1 a. State Coulomb's law of force between any two point charges and indicate the units of the quantities involved. **(06 Marks)**

b. Volume charge density, $\rho_v = 0$ for $\rho < 0.01$(m) and also for $\rho > 0.03$(m). In the region, $0.01 < \rho < 0.03$(m), $\rho_v = 10^{-8}\cos(50\pi\rho)$ (c/m^3), find electric flux density $\vec{D}$ everywhere. **(07 Marks)**

c. Evaluate both sides of gauss – divergence theorem for the field $\vec{D}\ 2xyz\vec{a}_x + 3y^2z\vec{a}_y + x\vec{a}_z (c/m^2)$. the region is defined by $-1 \le x, y, z \le 1$(m). **(07 Marks)**

2 a. Define electric scalar potential. With usual notations, establish the relationship between electric field intensity and electric scalar potential. **(06 Marks)**

b. A metallic sphere of radius 0.1(m) has a surface change density of 10(nc/m^2). Calculate electric energy stored in the system. Derive the formula employed. **(07 Marks)**

c. A capacitor has square plates each of side 'a'(m). The plates make an angle θ with each other. Show that for small θ, the capacitance is $C = \frac{\epsilon_0 a^2}{d}\left(1 - \frac{a\theta}{2d}\right)(F)$. **(07 Marks)**

3 a. Derive Poisson's and Laplace's equations. Write laplace's equation in CCS and SCS. **(06 Marks)**

b. Using laplace's equation, prove that the potential distribution at any point in the region between two concentric cylinders of radii A and B as $V = Vo\frac{\ln\left(\rho/B\right)}{\ln\left(A/B\right)}(\text{Volts})$ **(07 Marks)**

c. It is known that V = XY is a solution of laplace's equation, where X is a function of x alone and Y is a function y alone. Determine which of the following potential functions are also solutions of laplace's equation i) V = 100X, ii) V = 80XY, iii) V = 3XY + x – by. **(07 Marks)**

4 a. State and explain Biot – savart law. Using this, find the magnetic flux density at the centre of a circular current loop of radius 'a'(m) **(07 Marks)**

b. Magnetic field intensity in free space is $\vec{H} = 10\rho^2\vec{a}_\phi\left(A/m\right)$ Determine

i) $\vec{J}$

ii) Integrate $\vec{J}$ over the circular surface $\rho = 1$(m), all ϕ and $z = 0$. **(06 Marks)**

c. Verify the stoke's theorem for the field $\vec{H}\ 6xy\vec{ax} - 3y2\vec{ay}\left(A/B\right)$ and the rectangular path around the region, $2 \le x \le 5$, $-1 \le y \le 1$, Z = 0. Let the positive direction of $\vec{ds}$ be $\vec{a}_z$. **(07 Marks)**

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PART B

5 a. Obtain the expression of magnetic force between two current elements and hence fo[r] current loops. (06 Marks)

b. Find the magnetization in a magnetic material where:

i) $\mu = 1.8 \times 10^{-5}$ (H/m) and H = 120 (A/m).

ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3 and each atom has a dipole moment of 4.5×10^{-27} (A/m^2) and

iii) B = 300 (μT) and $\chi_m = 15$. (06 Marks)

c. Define self inductance. Find the same of a solenoid with air core has 2000 turns and [a] length of 500(mm) core with radius 40 (mm). (08 Marks)

6 a. Explain transformer and motional induced emfs. (06 Marks)

b. Show that an emf induced in a Faraday's disc generator is $e = -\frac{WBa^2}{2}$ (Volts), where 'W' is the angular velocity in rad/sec, B is the magnetic flux density in Tesla and 'a' is the radius of the disc in metre. (06 Marks)

c. Write the Maxwell's equations in point form for static fields and in integral form for time varying fields. (08 Marks)

7 a. Discuss the uniform plane wave propagation in a good conducting medium. (06 Marks)

b. The magnetic field intensity of uniform plane wave in air is 20 (A/m) in $\vec{a}_y$ direction. The wave is propagating in the $\vec{a}_z$ direction at an angular frequency of 2×10^9(rad/sec)

Find: i) Phase shift constant; ii) Wavelength;

iii) Frequency and iv) Amplitude of electric field intensity. (06 Marks)

c. A circular wire having a conductivity σ and radius 'a' carrying a direct current I(Amperes). Using Poynting's theorem, determine the net power entering the wire of length l(m). (08 Marks)

8 a. Derive the expressions for transmission co-efficient and reflection co-efficient. (08 Marks)

b. Define Standing Wave Ratio(S). What value of S results when reflection coefficient= $\pm$ ½? (04 Marks)

c. Given T=0.5, η_1=100 (Ω),η_2=300 (Ω), E^i_{x1}=100 (v/m). Calculate values for the incident, reflected and transmitted waves. Also show that the average power is conserved. (08 Marks)

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Third Semester B.E. Degree Examination, June-July 2009

Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least Two full questions from each part.***

PART – A

1 a. State and prove Divergence theorem. **(06 Marks)**

b. Define: i) Electric field intensity; ii) Electric flux density; iii) Volume charge density. **(06 Marks)**

c. Let $\vec{D} = 5r^2\,\hat{a}r$ mc/m^2 for $r \le 0.08$m and $\vec{D} = \frac{.205}{r^2}\hat{a}r$ μc/m^2 for $r \ge 0.08$m. Find ρ_v for i) r = 0.06m; ii) r = 0.1m. **(08 Marks)**

2 a. Derive the expression for the energy stored in Electrostatic field having electric field intensity $\vec{E}$. **(06 Marks)**

b. A 15-nc point charge is at the origin in free space. Calculate V_1 if point P is located at (2, -3, -1). Also calculate V_1 at P if V = 0 at (6, 5, 4). **(08 Marks)**

c. Derive point form of continuity equation. **(06 Marks)**

3 a. Derive Laplace's equations. **(05 Marks)**

b. Using Laplace equations, derive the expression for the capacitance of a co-oxial cable. **(10 Marks)**

c. Calculate the numerical values for V and ρ_v in free space of $V = \frac{4yz}{x^2+1}$ at p: (1, 2, 3). **(05 Marks)**

4 a. Derive the expression for field at a point P due to an infinitely long filament carrying direct current I. **(08 Marks)**

b. Explain scaler and vector Magnetic Potential. **(08 Marks)**

c. Calculate the value of vector current density in cylindrical co-ordinates at P: (1.5, 90^0, 0.5) if $\vec{H} = \frac{2}{\rho}\cos 0.2\phi ap$. **(04 Marks)**

PART – B

5 a. Define: i) Magnetization; ii) Permeability; iii) Torque. **(06 Marks)**

b. Obtain the boundary conditions at interface between two magnetic materials. **(06 Marks)**

c. Find Magnetization in magnetic material, where: **(08 Marks)**

i) $\mu = 1.8 \times 10^{-5}$ H/m and H = 120 A/m; ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3 and each atoms has a dipole moment of 4.5×10^{-27} A – m^2; iii) B = 300 μT and $X_m = 15$.

6 a. List Maxwell's equations in point form and integral form. **(08 Marks)**

b. Let $\mu = 10^{-5}$ H/m, $\in = 4 \times 10^{-9}$ F/m, $\sigma = 0$ and $\rho_v = 0$. Find K so that each of he following pair of fields satisfies Maxwell's equation.

i) $\vec{D} = \left(6\,\hat{a}_x - 2y\,\hat{a}_y + 2z\,\hat{a}_z \text{ nc/m}^2\right)$, $\vec{H} = \left(kx\,\hat{a}_x + 10y\,\hat{a}_y - 25z\,\hat{a}_z\right)$ A/m.

ii) $\vec{E} = (20y - kt)\hat{a}x$ v/m, $\vec{H} = (y + 2\times10^6 t)\,\hat{a}_z$ A/m **(06 Marks)**

c. Write a note on Retarded Potential. **(06 Marks)**

7 a. State and prove Poynting's theorem. **(10 Marks)**

b. Discuss the behaviour of good conductor when uniform ϕ line wove propagates through it. **(10 Marks)**

8 a. Discuss the problem of wave reflections from multiple interfaces. **(08 Marks)**

b. Define: i) Reflection coefficient; ii) Standing wave Ratios. **(04 Marks)**

c. Consider a 50 MHz uniform plane wave having Electric field amplitude 10 v/m. The medium is loss less having $\in_r = \in_{r1} = 9.0$ and $\mu r = 1.0$. The wave propagates in xy plane at 30° angle to x axis and is linearly polarized along z. Write the phasor expression for the electric field. **(08 Marks)**

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Third Semester B.E. Degree Examination, Dec.09/Jan.10

Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define electric field intensity due to a point charge in vector form. With usual notations, derive the expression for field at a point due to many charges. **(07 Marks)**

b. State and prove divergence theorem. **(05 Marks)**

c. Calculate the divergence of vector D at the points specified using cartesian, cylindrical and spherical coordinates:

i) $D = \frac{1}{z^2}[10xyz.a_x + 5x^2za_y + (2z^3 - 5x^2y)a_z]$ c/m^2 at point P(2, 3, 5)

ii) $D = 5z^2.a_\rho + 10\rho z . a_z$ at $\rho(3, -45°, 5)$ **(08 Marks)**

2 a. Define electric field and electric potential. With usual notations establish the relationship between electric field intensity and electric potential. **(10 Marks)**

b. With usual notations, derive the boundary conditions for perfect dielectric materials of permitivities $\in_1$ and $\in_2$. **(05 Marks)**

c. Given the potential field $V = 50x^2yz + 20y^2$ volts in free space, find

i) Potential V at P(1, 2, 3)

ii) $|E_p|$ (Magnitude of electric potential)

iii) $\hat{a}_r$ at P. **(05 Marks)**

3 a. With usual notations, deduce the Poisson's equation and Laplace equation from Maxwell's first equation. Express ∇^2V in different co-ordinate systems. **(10 Marks)**

b. Given $V = A\ln\left[B\frac{(1-\cos\theta)}{1+\cos\theta}\right]$ volts

i) Show that V satisfies Laplace equation in spherical coordinates.

ii) Find A and B so that V = 100V, $|E| = 500$ V/m at r = 5mt, $\theta = 90°$ and $\phi = 60°$. **(10 Marks)**

4 a. State and prove the Stroke's theorem. **(06 Marks)**

b. If the vector magnetic potential at a point in a space is given as $A = 100\,\rho^{1.5}a_z$ wb/mt, find the following: i) H ii) J and show that $\oint H.dl = I$ for the circular path with $\rho = 1$. **(06 Marks)**

c. In cylindrical coordinates, a magnetic field is given as $H = [4\rho - 2\rho^2]a_\phi$ A/m, $0 \le \rho \le 1$.

i) Find the current density or a function of ρ within cylinder.

ii) Find the total current that passes through the surface Z = 0 and $0 \le \rho \le 1$ mt in the a_z direction. **(08 Marks)**

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PART – B

5 a. With usual notations, derive the equation for magnetic force between two differential current elements. **(06 Marks)**

b. Find the torque vector on a square loop having corners (-2, -2, 0), (2, -2, 0), (2, 2, 0) and (-2, 2, 0) i) about the origin by $B = 0.4a_xT$ ii) About the origin by $B = 0.6a_x - 0.4a_yT$. **(06 Marks)**

c. Determine the mutual inductance between conducting loop and a very long straight wire shown in Fig.5(c). **(08 Marks)**

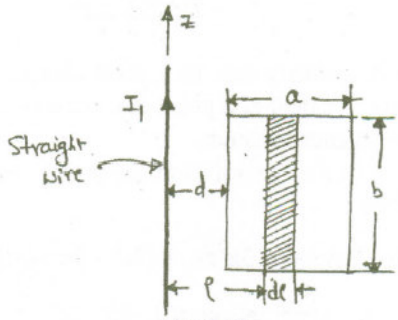


Fig.5(c)

6 a. With usual notations, derive the Maxwell's equation in point form as derived from Faraday's law. Hence show that electric field $E = 2x^3a_x + 4x^4a_y$ v/m can not arise from a static distribution of charges. **(08 Marks)**

b. With usual notations, derive the differential form of continuity equation from the Maxwell's equations. **(04 Marks)**

c. The time varying magnetic field in free space is given as $B = \begin{cases} 4\sin\omega t a_z & \rho \le \rho_0 \\ 0 & \rho > 0 \end{cases}$

Determine E using Faraday's law. Verify the same using Maxwell's equations. **(08 Marks)**

7 a. State and explain Polynting theorem. **(04 Marks)**

b. With usual notations, derive the expression for intrinsic impendence for lossy media. **(06 Marks)**

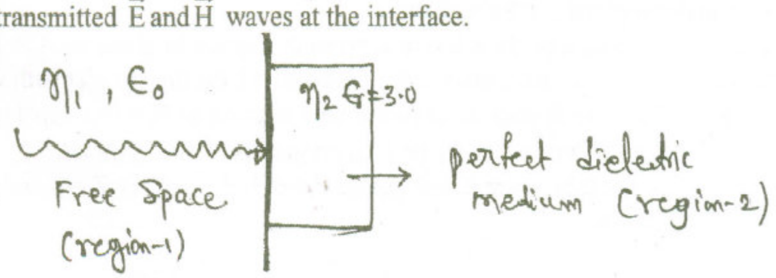
c. The electric field intensity of 300 MHz uniform plane wave in free space is given by $E = (20 + j50)(a_x + 2a_y)e^{-j\beta z}$ V/m. Find

i) ω, λ, u and β ii) E at t = 1 ns z = 10 cm iii) What is $|H|_{max}$? **(10 Marks)**

8 a. Write a short note on standing wave ratio (SWR). **(04 Marks)**

b. With usual notations, derive a general expression for a traveling plane wave. **(06 Marks)**

c. Travelling $\vec{E}$ and $\vec{H}$ waves in the free space (region-1) are normally incident on the interface with a perfect dielectric (region-2) with $\epsilon_r = 3.0$. Compare the magnitude of the incident wave and transmitted $\vec{E}$ and $\vec{H}$ waves at the interface.



(10 Marks)

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Third Semester B.E. Degree Examination, December 2011
Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define electric field intensity due to point charge in a vector form. With usual notations derive expressions for field at a point due to many charges. **(06 Marks)**

b. State and prove Gauss's law. **(06 Marks)**

c. Given $\vec{D} = 30e^{-r}\hat{a}_r - 2z\hat{a}_z\ c/mt^2$. Verify divergence theorem for the volume enclosed by $r = 2, z = 5$. **(08 Marks)**

2 a. Derive an expression for energy and energy density in an electrostatic field. **(04 Marks)**

b. A 15 nc point charge is at the origin in free space. Calculate v_1 if point P is located at P(–2, 3, –1) and : i) V = 0 at (6, 5, 4) ii) V = 0 at infinity. **(08 Marks)**

c. If $\vec{E} = -8xy\hat{a}_x - 4x^2\hat{a}y + \hat{a}_z$ v/m, find the work done in carrying a 6C charge from A(1, 8, 5) to B(2, 18, 6) along the path $y = 3x + 2$, $z = x + 4$. **(08 Marks)**

3 a. Starting with point form of Gauss law deduce Poisson's and Laplace's equations. **(06 Marks)**

b. Use Laplace's equation to find the capacitance per unit length of a co–axial cable of inner radius 'a' m and outer radius 'b' m. Assume $V = V_0$ at r = a and v = 0 at r = b. **(08 Marks)**

c. Determine whether or not the potential equations :
$V = 2x^2 - 4y^2 + z^2$ ii) $V = r^2 \cos\phi + \theta$ iii) $V = r\cos\phi + z$
satisfy the Laplace's equation. **(06 Marks)**

4 a. Starting from Biot–Savart law, derive an expression for the magnetic field intensity at a point due to finite length of current carrying conductor. **(06 Marks)**

b. Calculate the value of vector current density at P(1.5, 90°, 0.5) if $\vec{H} = \frac{2}{r}\cos 0.2\phi\,\hat{a}_r$. **(04 Marks)**

c. Evaluate both sides of the Stoke's theorem for the field $\vec{H} = 6xy\,\hat{a}_x - 3y^2\,\hat{a}_y$ A/m and the rectangular path around the region $2 \le x \le 5, -1 \le y \le 1, z = 0$. **(10 Marks)**

PART – B

5 a. Obtain boundary conditions at the interface between two magnetic materials. **(06 Marks)**

b. A circular loop of 10 cm radius is located in xy plane with magnetic field $\vec{B} = 0.5\cos(377t)[3\hat{a}_y + 4\hat{a}_z]\,T$. Calculate the voltage induced by the loop. **(06 Marks)**

c. A single trun circular coil 5 cm diameter carries a current of 2.8 A. Determine the magnetic flux density $\vec{B}$ at a point on the axis 10 cm from the center. Derive the formula used. **(08 Marks)**

1 of 2

Important Note : 1. On completing your answers, ...
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

10ESL37 – ANALOG ELECTRONICS LAB

SYLLABUS

Sub Code: 10ESL37	I.A. Marks: 25
Hours per week: 03	Exam Hours: 03
Total Hours: 42	Exam Marks: 50

NOTE: Use the Discrete components to test the circuits. LabView can be used for the verification and testing along with the above.

1. Wiring of RC coupled Single stage FET & BJT amplifier and determination of the gain-frequency response, input and output impedances.

2. Wiring of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit) (One Experiment)

3. Wiring of a two stage BJT Voltage series feed back amplifier and determination of the gain, Frequency response, input and output impedances with and without feedback (One Experiment)

4. Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for $f0 \leq 10$ KHz

5. Testing for the performance of BJT – Hartley & Colpitts Oscillators for RF range $f0 \geq 100$KHz.

6. Testing for the performance of BJT -Crystal Oscillator for $f0 > 100$ KHz

7 Testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection

8. Testing of Clamping circuits: positive clamping /negative clamping.

9. Testing of a transformer less Class – B push pull power amplifier and determination of its conversion efficiency.

10. Testing of Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency

11. Verification of Thevinin’s Theorem and Maximum Power Transfer theorem for DC Circuits.

12. Characteristics of Series and Parallel resonant circuits.

LESSON PLAN

Hours / Week: 3

IA Marks:25 **Total Hours:42**

Cycle. No	Expt. No.	Title of the Experiment
I	1)	Diode clipping (single/double ended)
	2)	Clamping circuits for specific needs: positive/negative clamping
	3)	Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency
	4)	Verification of Thevinin's Theorem and Maximum Power Transfer theorem for DC Circuits.
	5)	Characteristics of Series and Parallel resonant circuits.
	6)	RC coupled single stage FET/BJT
II	7)	BJT Darlington emitter follower
	8)	Two stage BJT Voltage series feed back amplifier
	9)	BJT-RC Phase shift Oscillator for f0 = 10 KHz
	10)	BJT – Hartley & Colpitts Oscillators for RF range f0=100KHz
	11)	BJT -Crystal Oscillator for f0 > 100 KHz
	12)	transformer less Class – B push pull power amplifier

QUESTION BANK (VIVA QUESTIONS)

1. Design an Darlington emitter follower pair for the given specification (V_{ce},I_E). Determine Gain , input and output impedances.

2. Design and test a voltage series feed back amplifier using FET to meet the following specifications with and without feedback .

i) Input impedence = 2MΩ
ii) Voltage gain = 2

3. Design the RC Phase shift oscillator for the frequency of __________ using a BJT .

4. Design a RC coupled single stage BJT amplifier and determine the gain frequency response , input and output impedence.

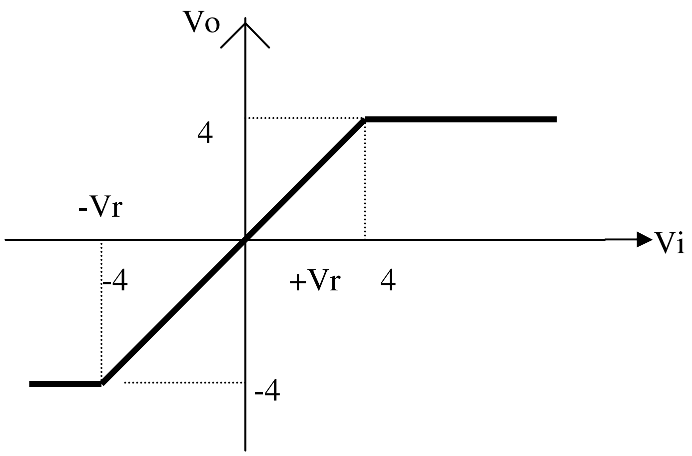
5. Design a circuit to convert the digital input to analog output for the step size of 0.5.

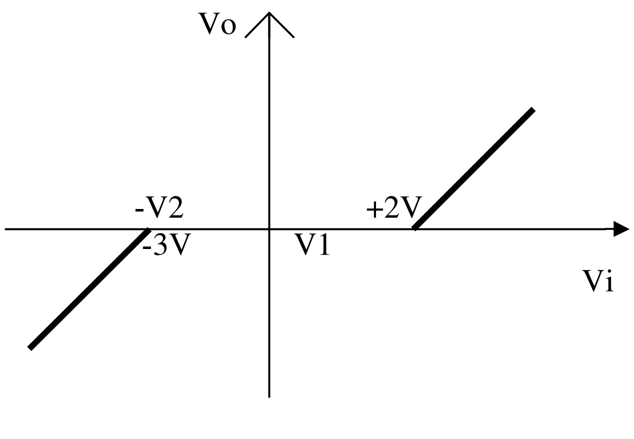
6. Design Hartley oscillator for a given frequency 200 khz / 100 khz using FET.

7. Design Colpitts oscillator for a given frequency 200 khz / 100 khz using FET.

8. a) Design a positive clamping circuit for given reference voltage of +2v.
b) Design a negative clamping circuit for a given reference voltage of +2v.

9. Design the clipping circuits for the following transfer function as shown in the fig. For a sinusoidal/triangular input, show output (Any two to be specified)





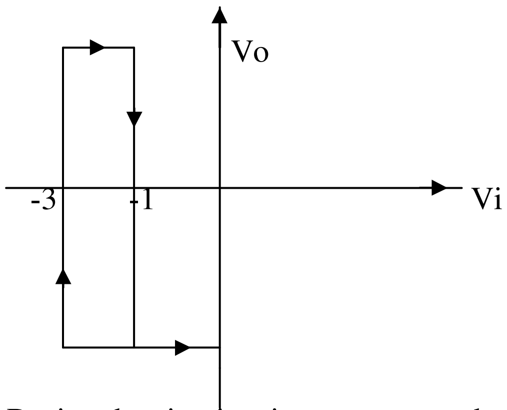
10. Construct and test an Op-amp circuit to obtain the following functions
- **i)** Inverting amplifier
- **ii)** Non inverting amplifier
- **iii)** Voltage follower

11.a) Convert the square wave into triangular wave using Op-amp
b) Convert the triangular wave into square wave using Op-amp

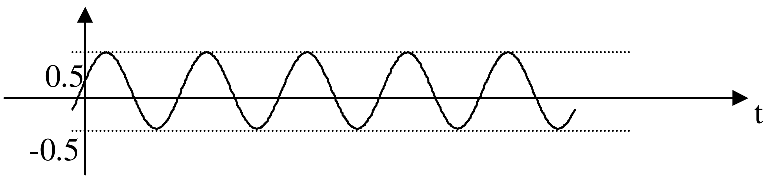
12. Construct the circuit for the given specifications using Op-amp
$Y= -(av_1+ bv_2+ cv_3)$ where V_1,V_2,V_3 are inputs and a,b,c are constants to be specified.

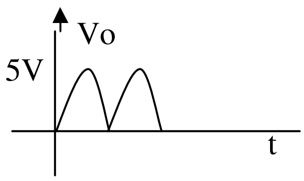
13. Design a Schmitt trigger circuit for the given values of UTP =+2v, LTP = -2V.

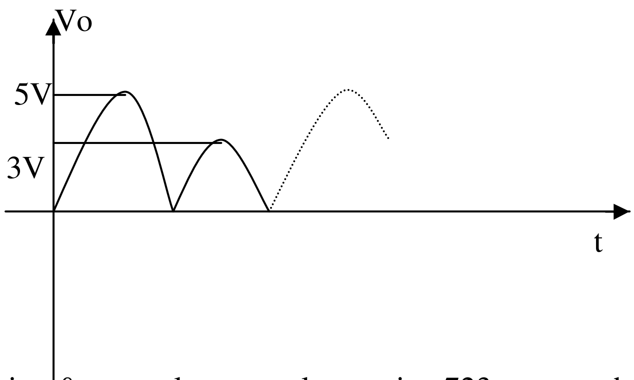
14. Design the circuit for the following hysterisis curve



15. Design the circuit using op-amp to obtain the output waveform shown for a sinusoidal input.







16. Design & test voltage regulator using 723 to meet the following specification
a) V_0=15V , I_L=100mA

17. Design & test voltage regulator using 723 to meet the following specification
V_0=5V , I_L=100mA

QUESTION BANK(Contd)

1. What is breakdown voltage in diodes?
2. What is cut-in voltage in diodes?
3. What are static and dynamic resistances of a diode?
4. What is reverse resistance of a diode?
5. What are the values of reverse resistances of different diodes?
6. What are the values of Cut-in Voltages of Si and Ge diode?
7. What are the values of Zener break down voltages of different Zener diode?
8. What is Zener breakdown voltage?
9. What is Avalanche breakdown voltage?
10. What are the differences between Avalanche and Zener Breakdown?
11. What is regulator?
12. What is Series Voltage Regulator?
13. What is Shunt Voltage Regulator?
14. What are the differences between Series and Shunt Voltage Regulator?
15. Define Stability factor
16. Define Regulation factor
17. What is the difference between AC and DC
18. What is rectifier?
19. What are different types of rectifier?
20. What is filter?
21. What are the different types of filter?
22. What is BJT?
23. What are the biasing techniques in CB / CE / CC mode?
24. What are the different types of configuration?
25. What are the h-parameters?
26. What are active, saturation and cutoff region?
27. What are the values of h-parameters in CE, CB and CC configuration?
28. What is the relation between α and β?
29. Define β and α.
30. Define the various regions in output characteristics in CE mode.
31. What is FET?
32. What are the differences between BJT and FET?
33. What is JFET?
34. What are the differences between UJT and BJT?
35. What is negative resistance?
36. What are KCL and KVL laws?
37. What is active element and give examples
38. What is passive element and give examples
39. What are the differences between active and passive elements?
40. What is voltage source?
41. What is current source?
42. What is the difference between dependent and independent sources?
43. Define bandwidth
44. Define half power frequencies
45. Why should we take –3dB to find the cutoff frequencies?
46. What is frequency response?
47. How will you convert amplitude in dB?
48. What are the differences between Series and Parallel Resonance?
49. What is RC Coupling?

50. What are the pros and cons of RC Coupling?
51. What are the applications of RC Coupling?
52. What is emitter follower?
53. What are the values of h-parameter in CC configurations?
54. Why is the output equal to input amplitude?
55. What are the applications of emitter follower?
56. What is the advantage of Darlington Emitter Follower over conventional
57. Emitter Follower Circuit.
58. What is the input & output impedances of Darlington Emitter Follower
59. What is the stability factor for Darlington Emitter Follower
60. What is the purpose of using Voltage series feedback amplifier?
61. State Barkheusan criterion
62. Why BJT is called current controlled device.
63. What are the other names of cut off frequencies?
64. If bandwidth is very high what is the Q –factor of an amplifier.
65. What is meant by resonant frequency?
66. What are the classifications of tuned amplifier?
67. What is the frequency range of a Hartley & collpits oscillator?
68. What are the applications of clampers & clippers?
69. What are the different types of biasing techniques.
70. What are the uses of coupling & by-pass capacitors.
71. What is the gain Band width product of an amplifier. Is it a variable or constant?
72. Why FET is called as an voltage controlled device.
73. Why Band width increases in Negative feed back amplifiers.

10ESL38 – LOGIC DESIGN LAB

SYLLABUS

Sub Code: 10ESL38	I.A. Marks: 25
Hours per week: 03	Exam Hours: 03
Total Hours: 42	Exam Marks: 50

NOTE: Use discrete components to test and verify the logic gates. LabView can be used for designing the gates along with the above.

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.

2. Realization of Half/Full adder and Half/Full Subtractors using logic gates.

3. (i) Realization of parallel adder/Subtractors using 7483 chip
   (ii) BCD to Excess-3 code conversion and vice versa.

4. Realization of Binary to Gray code conversion and vice versa

5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.

6. Realization of One/Two bit comparator and study of 7485 magnitude comparator.

7. Use of a) Decoder chip to drive LED display and b) Priority encoder.

8. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.

9. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).

10. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.

11. Wiring and testing Ring counter/Johnson counter.

12. Wiring and testing of Sequence generator.

LESSON PLAN

SUB CODE:10ESL38 **Hours / Week: 3**
IA Marks:25 **Total Hours:42**

S. No. **Topic to be covered**

CYCLE I

1. Simplification, Realization of Boolean expressions using LOGIC gates / UNIVERSAL gates.
2. Realization of half/full adder and half/full subtractor using logic gates.
3. **(i)** Realization of parallel adder /subtractor using 7483 chip
(ii) BCD to Ex-3 code conversion & vice versa.
4. Realization of binary to gray code converter and vice versa .
5. MUX/DEMUX use of 74153,74139 for arithmetic circuits and code converter.

CYCLE II

6. Realization of one/two bit comparator & study of 7485 magnitude comparator.
7. Use of a) decoder chip to drive LED/LCD display and b) priority encoder.
8. Truth table verification of flip-flops (i) JK master slave (ii) T-type and (iii) D type.
9. Realization of 3-bit counters as a sequential circuit & mod-N counter design (7476,7490,74192,74193)
10. Shift left, shift right, SIPO, SISO, PISO, PIPO operations using 7495.
11. Design and testing of ring counter/Johnson counter.

CYCLE III

12. Design of a sequence generator.
13. Design and testing of astable and mono-stable circuits using 555 timer.
14. Programming a RAM (2114).

QUESTION BANK (VIVA QUESTION)

1. What is Number System? Classify
2. Define Base of a number or Radix of a number system.
3. What is logic gate? Classify
4. Why NAND and NOR are called as Universal gates.
5. What is the difference between Binary addition and Boolean addition
6. What is the difference between postulate and Law?
7. What is Idempotent law?
8. Define truth table.
9. What is the need for simplification of Boolean expression?
10. What are the methods followed to simplify a given Boolean expression.
11. Which is the best method to perform simplification.
12. Using K-map, to haw many variables maximum can be simplified.
13. Define cell.
14. What is the difference between Prime implicants and essential prime implicants?
15. Difference between Minterm and Maxterm.
16. What is SOP and POS
17. In K-Map what type of coding is used? Why other codes are not used.
18. What do you mean by ORing of AND terms and ANDing of OR terms
19. Realize the XNOR function using only XOR gates.
20. What do π and Σ indicate.
21. How do you convert SOP into POS and vice versa
22. Does NAND gate obey the commutative, associative and distributive laws? Justify your answer with Boolean equation.
23. Define the function of half adder, Full adder, half subtractor, and full Subtractor.
24. What is the difference between carry and overflow.
25. What is the function of Parallel adder and subtractor?
26. Give the pin configuration of IC 7483.
27. What is the need for complements?
28. Classify the types of complements.
29. The 10's and 9's complement are performed over ------------------ numbers and 1's & 2's complements are performed over --------------------- numbers.
30. How the two's complement operation is achieved using IC 7483.
31. What is the need for XOR gates in Parallel adder and subtractor?
32. What are the conditions required to perform Parallel addition, 1's complement parallel subtraction, and 2's complement parallel subtraction.
33. What is the largest decimal number that can be added with a parallel adder consisting of four full adders?
34. To perform addition of two 6-bit numbers, we need a parallel adder having ---------- full adder circuits
35. Can addition of two BCD numbers be performed using IC 7483? If yes, what are the changes to be made in the circuit?
36. While adding two BCD numbers, if the sum is not a BCD number, what is to be done?
37. What is the reason for adding only 6 and not any other number to the sum of BCD number?
38. Is it possible to perform the addition of XS3 codes using IC 7483?
39. What is code conversion?
40. Explain the need for code conversion.
41. What are the steps involved to convert a binary number into a Gray Code?
42. What are the steps involved to convert a Gray number into a binary Code?

43. Is gray code a weighted code?
44. What is weighted code? Give examples
45. What is Non – weighted codes, give example?
46. What are reflected codes give examples?
47. What are self-complementary codes give examples?
48. What is BCD code?
49. Where are BCD codes used?
50. What was the need for binary number system? Give its advantages over others.
51. How are XS3 codes derived?
52. Define the function of Multiplier.
53. For a 16: 1 MUX, How many AND gates and select lines are needed.
54. What is the need for select lines or control lines
55. Give the relationship between number of input lines and number of select lines
56. To construct a 32:1 MUX how many 4:1 MUX is required.
57. Give some practical applications of Multiplexers.
58. Define the function of Demultiplexer.
59. What is the need for ENABLE input in DEMUX.
60. When does a DEMUX act as a decoder? What is the condition?
61. Give some practical applications of DEMUX.
62. How do you design any code converters using DEMUX IC.
63. Give the pin configuration of IC 74139 and IC 74153.
64. What is the function of comparator?
65. How can we compare any 2 bit binary numbers?
66. Is it possible to compare 2 bit binary number using IC 7483? If yes, how?
67. How do you compare 4 bit binary number
68. What is a magnitude comparator?
69. We can divide a number into two parts. What are they?
70. If a number is a positive number, then sign bit is ---------------- and a number if negative, then sign bit is --------------------.
71. What is magnitude of a number?
72. What is meant by cascading inputs?
73. Define Logic 1 and logic 0?
74. Let A be a 2 bit number and B be another 2 bit number, if A > B, then C_{out} = ------ and S = ----------, if A < B, then C_{out} = ---------- and S = ------------, and if A = B, then C_{out} = ---------- and S = ------------.
75. Is it possible to perform comparison of two, 8-bit number using magnitude comparator?
76. Where are the comparators used?
77. What is a Flip-flop?
78. What is the difference between a flip-flop & latch?
79. How J-k flip-flop can be converted into T & D types?
80. What is the difference between Synchronous and Asynchronous clock pulse.
81. How to design a Mod-N counter?
82. How addition and subtraction is done in a parallel adder circuits.
83. Explain the design for a Sequence Generator if the sequence given is ………………...
84. What is the difference between a sequence generator and PRBS?
85. Give the difference between sequential and combinational circuit.
86. What is a shift register?
87. What are the different modes of operation in a shift register?
88. What is the function of mode-control pin?
89. What is the difference between common cathode configuration and common anode configuration?
90. Give the difference between LED and LCD.

91. How does an LED work?
92. What is meant by active low and active High?
93. What does Pull-up resistor or current – limiting resistor, mean?
94. Why R is chosen as 330Ω?
95. What is the function of a decoder?
96. Give the pin configuration of decoder chip?
97. What is the function of R_{BO}, R_{B1} and LT?
98. What is an Encoder?
99. What is priority encoder?
100. Give the difference between encoder and priority encoder?
101. What is the need for inverter in the priority encoder circuit?
102. Is AND gate equivalent to series switching circuit?
103. What are bubbled gates?
104. ------------------- Gate is also called all – or - nothing gate.
103.------------------- Gate is also called any – or – all gate.
104. Define byte, nibble and bit?
105. What do the following indicate – a bubble at input end and a bubble at output end?
106. What are the types of Multivibrator?
107. What is the other name of Astable Multivibrator?
108. How to change the duty cycle of an Astable Multivibrator of an output Frequency?