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

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

Time: 3 hrs. Max. Marks:100

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

PART - A

1

a. Find the Fourier series fort he function $f(x) = |x|$ in $-\pi \leq x \leq \pi$.

Hence deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+........=\frac{\pi^2}{8}$ **(06 Marks)**

b. Expand the function f(x) defined by

$$f(x) = \begin{cases} \frac{1}{4}-x & \text{for} \quad 0<x<\frac{1}{2} \\ x-\frac{3}{4} & \text{for} \quad \frac{1}{2}<x<1 \end{cases}$$

In a half – range sine series. **(07 Marks)**

c. Obtain the complex Fourier series for the function

$$f(x) = \begin{cases} 0 & \text{for} \quad 0<x<l \\ a & \text{for} \quad l<x<2l \end{cases}$$

Over the interval $(0, 2l)$. **(07 Marks)**

2

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

Hence evaluate $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3}\right)\cos\frac{x}{2}\,dx$. **(06 Marks)**

b. Solve the integral equation :

$$\int_0^\infty f(\theta)\cos\alpha\theta\, d\theta = \begin{cases} 1-\alpha, & 0\leq\alpha\leq 1 \\ 0, & \alpha>1 \end{cases}$$

Hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2}\,dt$. **(07 Marks)**

c. Show that the inverse finite Fourier sine transform of

$$F_s(n)=\frac{1}{n}\left\{1+\cos n\pi-2\cos\frac{n\pi}{2}\right\}$$

is $f(x) = \begin{cases} 1, & 0\leq x\leq \pi/2 \\ -1, & \pi/2<x\leq\pi \end{cases}$ **(07 Marks)**

3

a. Form a partial differential equation by eliminating the arbitrary functions f and g from the relation

$Z = f(y+2x) + g(y-3x)$ **(06 Marks)**

b. Solve the equation $\frac{\partial^2 z}{\partial x^2} = x+y$, given that $z = y^2$ when $x = 0$, and $\frac{\partial z}{\partial x} = 0$, when $x = 2$. **(07 Marks)**

c. Solve : $(y+z)\,p + (z+x)\,q = x+y$. **(07 Marks)**

4 a. Derive the one-dimensional heat equation. **(06 Marks)**

b. Obtain D′ Alembert's solution of the one dimensional wave equation:

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}.$$ **(07 Marks)**

c. Solve the wave equation $c^2 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}, 0 < x < l$ under the following conditions :

i) $u(0,t) = u(l,t) = 0$; ii) $u(x,0) = u_o \text{ Sin } \frac{\pi x}{l}$; iii) $\frac{\partial u}{\partial t}(x,0) = 0$ **(07 Marks)**

PART - B

5 a. Using the Regula – Falsi method, find the root of the equation $xe^x = \cos x$ that lies between 0.4 and 0.6. Carry out four iterations. **(06 Marks)**

b. Solve the following system of equations by using the Gauss – Jordan method :

$x + y + z = 9$
$2x + y - z = 0$
$2x + 5y + 7z = 52.$ **(07 Marks)**

c. Using the power method, find the largest eigenvalue and the corresponding eigenvector of the matrix

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & 1 \\ 2 & -1 & 3 \end{bmatrix}$$

Taking $[1, 1, 1]'$ as the initial eigenvector. Perform five iterations. **(07 Marks)**

6 a. Find the interpolating polynomial for the function $y = f(x)$ given by $f(0) = 1$, $f(1) = 2$, $f(2) = 1$ $f(3) = 10$. Hence evaluate $f(0.75)$. **(06 Marks)**

b. Apply Lagrange's formula to find a root of the equation $f(x) = 0$, given that $f(30) = -30$, $f(34) = -13$, $f(38) = 3$, $f(42) = 18$. **(07 marka)**

c. Evaluate $\int_0^{\pi/2} \sqrt{\cos\theta \, d\theta}$ by using the Simpson's $\frac{1}{3}$ rule, taking 9 ordinates. **(07 Marks)**

7 a. Derive Euler's equation in the form

$$\frac{df}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$ **(06 Marks)**

b. Find the external of the functional

$$I = \int_0^{\pi/2} (y^2 - y'^2 - 2y \text{ Sin} x) dx$$

Under the end conditions $y(0) = y\left(\pi/2\right) = 0.$ **(07 Marks)**

c. Prove that catenary is the curve which when rotated about a line generates a surface of revolution of minimum area. **(07 Marks)**

8 a. Find the Z –transforms of

i) Coshn θ; ii) Sin (3n +5). **(06 Marks)**

b. Obtain the inverse Z – transform of

$$\frac{3z^2 + z}{(5z-1)(5z+2)}.$$ **(07 Marks)**

c. By employing Z – transform, Solve the difference equation : $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$, with $y_0 = y_1 = 0.$ **(07 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 $\int_0^5 \int_0^{x^2} x(x^2 + y^2)\,dx\,dy$. **(07 Marks)**

c. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dx\,dy\,dz$. **(07 Marks)**

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

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

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

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

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

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

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

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

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

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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)**

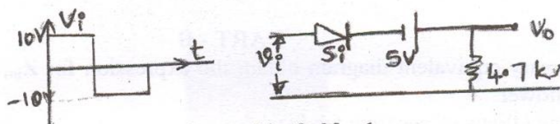

Fig Q. No. 1c.

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)**

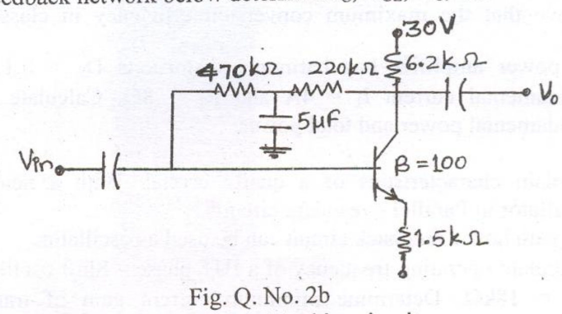

Fig. Q. No. 2b

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)**

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)**

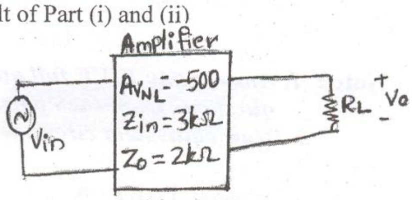

Fig. Q.No. 3c.

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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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)**

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 S_0	S_1	Data line selected	Register operation
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)**

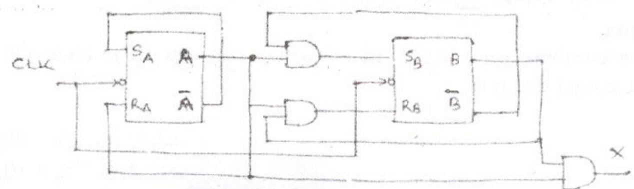

Fig. Q7 (b)

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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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)**

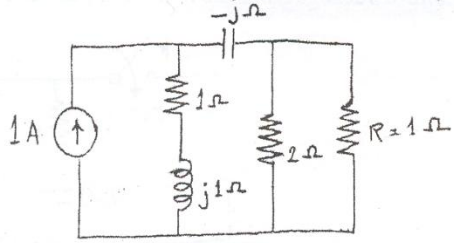

Fig.1(b)

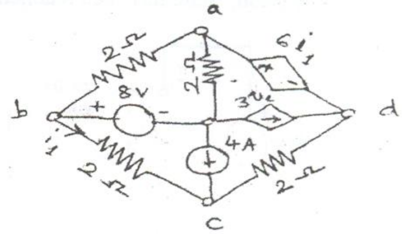

Fig.1(c)

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)**

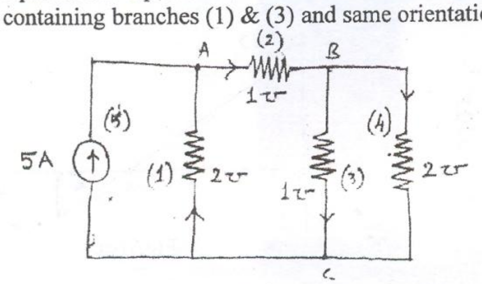

Fig.2(b)

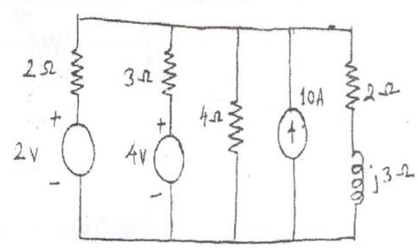

Fig.4(c)

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)**

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)**

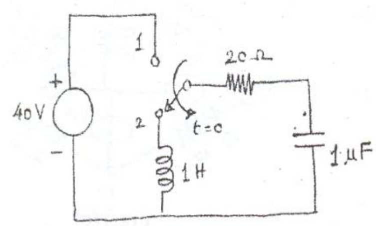

Fig.6(a)

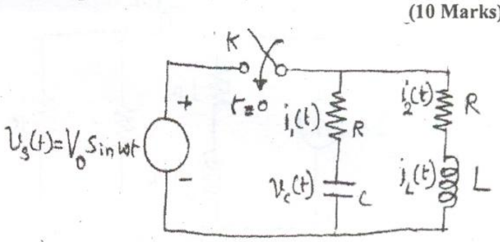

Fig.6(b)

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)**

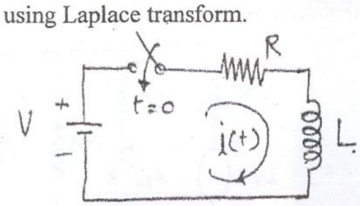

Fig.7(b)

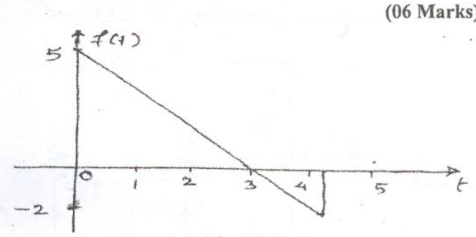

Fig.7(c)

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)**

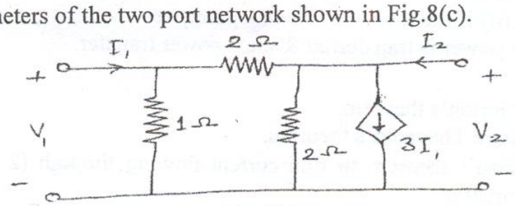

Fig.8(c)

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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)**

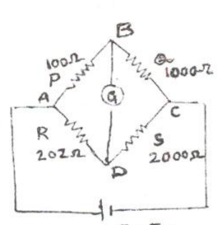

Fig. Q6 (a)

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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06ES36

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 $C = \frac{\epsilon_o a^2}{d}\left(1 - \frac{a\theta}{2d}\right)$(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 $V = Vo\frac{\ln\left(\rho/B\right)}{\ln\left(A/B\right)}$(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)**

PART B

5 a. Obtain the expression of magnetic force between two current elements and hence for 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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