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06MAT31

Third Semester B.E. Degree Examination, June / July 08
Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Expand the function $f(x) = x \sin x$ as a Fourier series in the interval $-\pi \le x \le \pi$. **(07 Marks)**

b. Obtain a half range cosine for **(07 Marks)**

$$f(x) = \begin{cases} kx & \text{for } 0 \le x \le l/2 \\ k(l-x) & \text{for } l/2 \le x \le l. \end{cases}$$

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
Y :	9	18	24	28	26	20

2 a. Find the Fourier transform of

$$f(x) = \begin{cases} 1 - x^2 & \text{if } |x| \le 1 \\ 0 & \text{if } |x| > 1 \end{cases}$$ and use it to 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 e^{-x^2}. **(07 Marks)**

c. Using convolution theorem, find the inverse Fourier transform of $H(\alpha) = \frac{1}{(1+\alpha^2)^2}$. **(06 Marks)**

3 a. Form the partial differential equation by eliminating the arbitrary functions $F(x+2y) + G(x-3y) = 0$. **(07 Marks)**

b. Use the separation of variable technique to solve $3 U_x + 2 U_y = 0$. Given $U(x, 0) = 4 e^{-x}$. **(07 Marks)**

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

4 a. Derive the one dimensional wave equation in the standard form. **(06 Marks)**

b. Obtain the various solutions of the Laplace's equation $Uxx + Uyy = 0$ by the method of separation of variables. **(07 Marks)**

c. A tightly stretched string of length l with fixed ends is initially in equilibrium position. It is set to vibrate by giving each point a velocity $V_0 \sin^3 \frac{\pi x}{l}$. Find the displacement $y(x, t)$. **(07 Marks)**

PART – B

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

b. Solve the following system of equations by Gauss – Seidel iteration method.
$27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$. **(07 Marks)**

c. Find the largest Eigen value and the corresponding Eigen vector of the following matrix by using power method : $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$. Take $(1\ 0\ 0)^T$ as the initial Eigen vector. Carry out 4 iterations. **(06 Marks)**

6 a. Use Newton's divided difference formula to find f(8) given. **(07 Marks)**

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

b. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.05 given **(07 Marks)**

x : 1	1.05	1.1	1.15	1.2	1.25	1.3
f(x) : 1	1.0247	1.04881	1.07238	1.09544	1.11803	1.14017

c. By Dividing the range into 6 equal parts, find the approximate value of $\int_0^{\pi} e^{\sin x}\, dx$ using simpsons 1/3rd rule. **(06 Marks)**

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

b. Find the extremal of the function $\int_0^{\pi/2} (y'^2 - y^2 + 4y \cos x)\, dx$ given $y(0) = 0$, $y(\pi/2) = 0$. **(06 Marks)**

c. 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)**

8 a. Find the Z – transform of i) n^2 ii) $\cos n\theta$. **(07 Marks)**

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

c. Solve the difference equation $Y_{n+2} + 2Y_{n+1} + Y_n = n$ with $Y_0 = Y_1 = 0$, using Z – transforms. **(06 Marks)**

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

Advanced Mathematics I

Time: 3 hrs. Max. Marks:100

Note : *Answer any FIVE full questions.*

1 a. Find the modulus and amplitude of $\frac{(3-\sqrt{2}i)^2}{1+2i}$. **(06 Marks)**

b. Express the complex number $\frac{(1-i)(2-i)}{3-i}$ in the form of x + iy. **(07 Marks)**

c. Express the complex number $-1+i\sqrt{3}$ in the polar form. **(07 Marks)**

2 a. If $y = e^{-x}\sinh 3x \cosh 2x$, find y_n. **(06 Marks)**

b. If $y = \tan^{-1}x$, then prove that $(1+x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$. **(07 Marks)**

c. Expand $\sin x$ in ascending powers of $\left(x-\frac{\pi}{2}\right)$. **(07 Marks)**

3 a. State Maclaurins theorem and find expansion of e^x. **(06 Marks)**

b. State Taylor's theorem and find the expansion of $\sin x$ in powers of $\left(x-\frac{\pi}{2}\right)$. **(06 Marks)**

c. If $u = e^{x/t^2}$, then prove that $2x\frac{\partial u}{\partial x} + t\frac{\partial u}{\partial t} = 0$. **(08 Marks)**

4 a. If $u = \sin^{-1}\left(\frac{x^2y^2}{x+y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3\tan u$. **(06 Marks)**

b. If $u = f(y-z,\ z-x,\ x-y)$, prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. **(07 Marks)**

c. If $x = u(1+v)$, $y = v(1+u)$, show that $\frac{\partial(x,\ y)}{\partial(u,\ v)} = 1+u+v$. **(07 Marks)**

5 a. Derive the reduction formula for $\int \sin^n x\,dx$, where n is + ve integer. **(06 Marks)**

b. Evaluate $\int_0^1 x(1-x^2)^{1/2}dx$. **(07 Marks)**

c. Evaluate $\int_0^1 \int_{x^2}^{2-x^2} xy\,dx\,dy$ **(07 Marks)**

6 a. Evaluate $\int_{-1}^{1}\int_0^z\int_{x-z}^{x+z}(x+y+z)dxdydz$ **(06 Marks)**

b. Prove that $\beta(m,n) = \frac{\Gamma m \Gamma n}{\Gamma m+n}$, m, n > 0. **(08 Marks)**

c. Evaluate $\int_0^{\frac{\pi}{2}}\sqrt{\cot\theta}\,d\theta$ by expressing in terms of gamma functions. **(06 Marks)**

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

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

c. Solve $(e^y+1)\cos x dx + e^y \sin x dy = 0$. **(07 Marks)**

8 a. Solve $x\frac{dy}{dx} + y = x^3y^6$. **(06 Marks)**

b. Solve $(D^3-1)y = 0$. **(07 Marks)**

c. Solve $(D^3-6D^2+5D)y = (5+x^2)$. **(07 Marks)**

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

Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

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

PART A

1 a. Differentiate between static and dynamic resistance of a semi conductor diode. **(04 Marks)**

b. Explain with the help of a circuit diagram the working of a Full Wave Rectifier. Derive expressions for i) I_{dc} ii) I_{rms} iii) V_{dc} iv) Ripple factor v) Rectifier efficiency. **(10 Marks)**

c. For the circuit shown, in Fig.Q1(c) write the transfer characteristic equations. Assume diodes are ideal. Plot V_0 against V_i, indicating all slopes and voltage levels. **(06 Marks)**

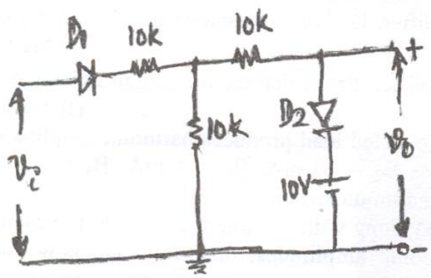

Fig.Q1(c)

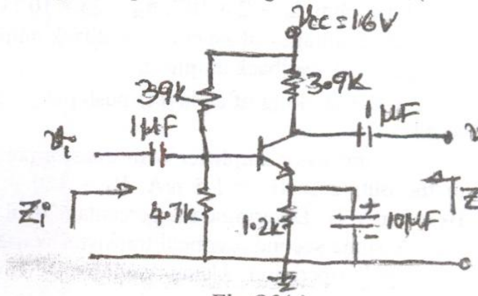

Fig.Q3(a)

2 a. Design a voltage divider bias circuit with V_{CC} = 10 V, R_C = 1.5 K ohm, I_C = 2 mA, V_{CE} = 5 V, β = 50. Assume silicon transistor and stability factor S = 5. **(08 Marks)**

b. Derive an expression for the stability factor $S(I_{CO})$ for a voltage divider bias circuit. **(08 Marks)**

c. Determine R_B and R_C for the transistor inverter of Fig.Q2(c) if I_{Csat} = 10 mA. **(04 Marks)**

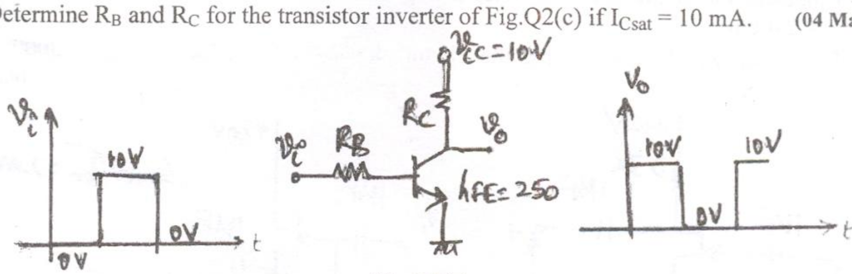

Fig.Q2(c)

3 a. For the network of Fig.Q3(a): i) Determine r_e ii) Calculate Z_i and Z_0 iii) Find A_V Given β = 100 S_i transistor. **(08 Marks)**

b. Draw the emitter follower circuit. Derive expressions for: i) Z_i ii) Z_0 iii) A_V using r_e model. **(08 Marks)**

c. Define h-parameters. Draw the h-parameter model of a transistor. **(04 Marks)**

4 a. Determine the lower cutoff frequency for the network of Fig.Q4(a). Given β = 100, $r_0 = \infty$ ohm. Determine the mid band gain. If C_{be} = 36 pF, C_{bc} = 4 pF, C_{w_i} = 6 pF, C_{w_0} = 8 pF. Determine f_{H_i} and f_{H_0} and sketch the frequency response for low and high frequency regions using the results. **(12 Marks)**

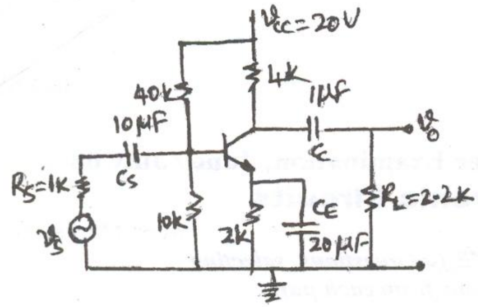

Fig.Q4(a)

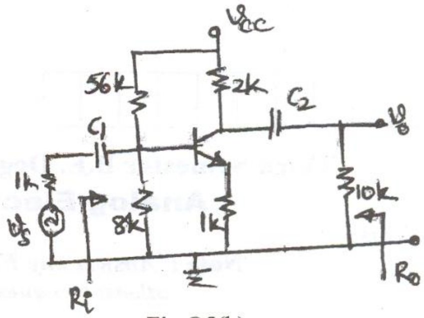

Fig.Q5(b)

b. Calculate the overall lower 3 db and upper 3 db frequencies for a 3 stage amplifier having an individual f_1 = 40 Hz and f_2 = 2 MHz. **(08 Marks)**

PART B

5 a. Draw the cascade configuration and list the advantages of this circuit. **(04 Marks)**

b. Determine A_i, R_i, A_v and R_0 for the circuit shown in fig.Q5(b). Given h parameters h_{ie} = 1.1 k ohm, $h_{re} = 2 \times 10^{-4}$, $h_{oe} = 25 \times 10^{-6}$ ℧, h_{fe} = 50. **(08 Marks)**

c. List the advantages of negative feedback amplifier. Derive expressions for Z_{if} and Z_{of} for voltage series feedback amplifier. **(08 Marks)**

6 a. Explain the working of a class B push pull amplifier. Prove that the maximum efficiency is 78.5%. **(10 Marks)**

b. A single transistor amplifier with transformer coupled load produces harmonic amplitudes in the output as B_0 = 1.5 mA, B_1 = 120 mA, B_2 = 10 mA, B_3 = 4 mA, B_4 = 2 mA, B_5 = 1 mA. i) Determine the percentage total harmonic distortion

ii) Assume second identical transistor is used along with suitable transformer to provide push pull operation. Using the above harmonic amplitudes, determine the new total harmonic distortion. **(10 Marks)**

7 a. Explain with the help of a circuit diagram, the working of an RC phase shift oscillator. **(08 Marks)**

b. With the help of Barkhousen criterion, explain the working of a BJT crystal oscillator. **(08 Marks)**

. Calculate the frequency of a Wien Bridge oscillator circuit when R = 12 k ohm and C = 2400 pf. **(04 Marks)**

8 a. Determine Z_i, Z_0 and A_v for the circuit shown in Fig.Q8(a), if Y_{fs} = 3000 μs and Y_{os} = 50 μs. **(06 Marks)**

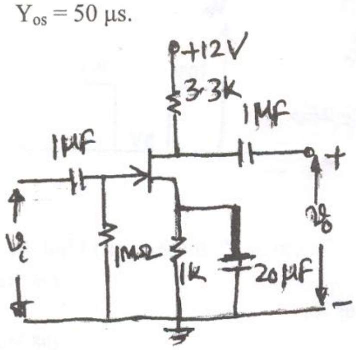

Fig.Q8(a)

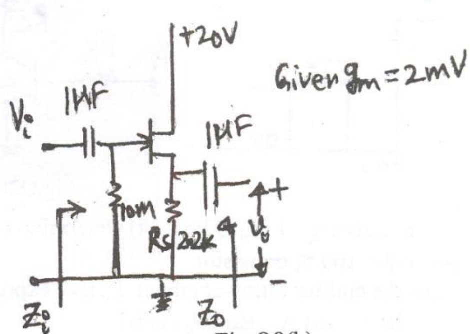

Fig.Q8(b)

b. Determine Z_i, Z_0, and A_v if r_d = 40 kΩ for fig.Q8(b). **(06 Marks)**

c. With the help of circuits and equations, show different biasing arrangements for depletion type MOSFET. **(08 Marks)**

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Third Semester B.E. Degree Examination, June / July 08
Logic Design

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE questions, choosing atleast two from each part.***

PART - A

1 a. Simplify the following expression using Karnaugh Map. Implement the simplified circuit using the gates as indicated.

i) $f(ABCD) = \Sigma m(2,3,4,5,13,15) + \Sigma\alpha(8,9,10,11)$ use only NAND gates

ii) $f(ABCD) = \pi(2,3,4,6,7,10,11,12)$ use only NOR gates

to implement these circuits. **(12 Marks)**

b. Fig shows a BCD counter that produces a 4 –bit output representing the BCD code for the number of pulses that have been applied to the counter input. For example, after four pulses have occurred, the counter outputs are $(ABCD) = (0100)_2 = (04)_{10}$. The counter resets to 0000 on the tenth pulse and starts counting over again. Design the logic circuit that produces a HIGH output. Whenever the count is 2, 3 or 9. Use K – mapping and take advantages of "don't care" conditions. Implement the logic circuit using NAND gates.

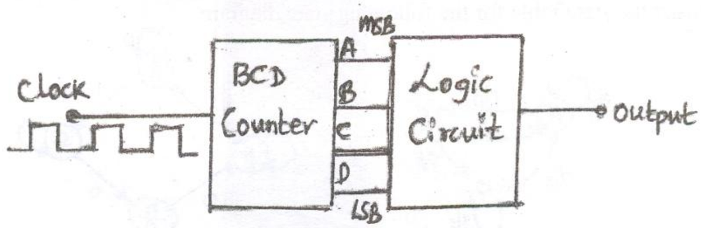

Fig. Q 1(b) **(08 Marks)**

2 a. Simplify the logic function given below, using Quine–McCluskey minimization technique. $Y(ABCD) = \Sigma m(0,1,3,7,8,9,11,15)$. Realize the simplified expression using universal gates. **(12 Marks)**

b. Simplify the logic function given below using variable – entered mapping (VEM) technique. $Y(ABCD) = \Sigma m(1,3,4,5,8,9,10,15) + \Sigma d(2,7,11,12,13)$. **(08 Marks)**

3 a. Realize the following Boolean function $f(ABCD) = \Sigma(0,1,3,5,7)$

Using – i) 8 : 1 MUX(74151) ii) 4 : 1 MIX(74153). **(08 Marks)**

b. Design a combinational logic circuit that will convert a straight BCD digit to an Excess – 3 BCD digits.

i) Construct the truth table

ii) Simplify each output function using Karnaugh Map and write the reduced equations.

iii) Draw the resulting logic diagram. **(12 Marks)**

4 a. Design a 4 – bit BCD adder circuit using 7483 IC chip, with self correcting circuit. i.e., a provision has to be made in the circuit, in case if the sum of the BCD number exceeds 9. **(12 Marks)**

b. Design a combinational circuit that accepts two unsigned 2 – bit binary number and provides 3 outputs.

Inputs : word $A = A_1A_0$, word $B = B_1B_0$.

Output : A = B, A>B, A<B. **(08 Marks)**

PART - B

5 a. Derive the characteristics equations of the following flip flops.
i) SR flip flops ii) JK flip flop. **(10 Marks)**

b. Explain clearly the operation of an asynchronous inputs in a flip flops with suitable example. **(06 Marks)**

c. An edge triggered 'D' flip flop is connected as shown in the Fig. Q 5(b). Assume that Q = 0 initially and sketch the wave form and determine its frequency of the signal at 'Q' output.

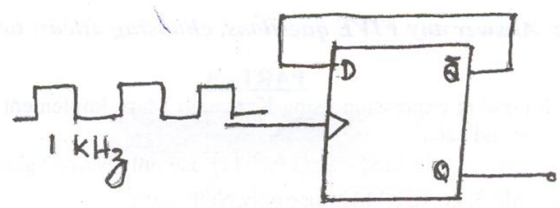

Fig. Q 5(C) **(04 Marks)**

6 a. With the help of a suitable example, explain the following operations in a shift register.
i) SISO ii) PISO iii) Twisted ring counter. **(10 Marks)**

b. Design a ripple counter to count the following sequence, 1111, 1110, 1101, 1100, 1011, 1111, 1110, 1101, 1100, 1011, etc. Suggest a suitable circuit using 7490 and other gates to obtain the desired result. **(10 Marks)**

7 a. With a suitable example, explain the Mealy and Moore Model of a sequential circuit. **(10 Marks)**

b. Construct the state table for the following state diagram.

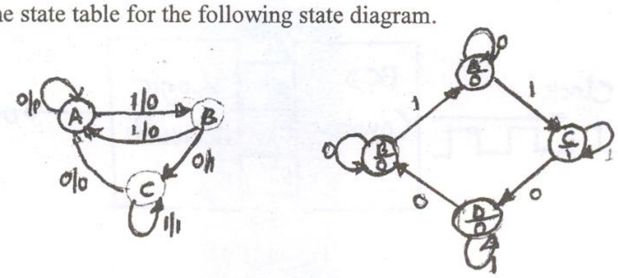

Fig. Q 7(c) **(10 Marks)**

8 a. Design a clocked sequential circuit that operates according to the state diagram shown. Implement the circuit using D – flip flop.

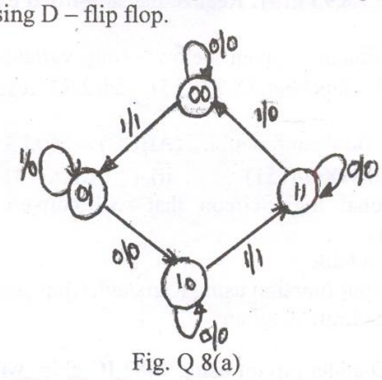

Fig. Q 8(a) **(12 Marks)**

b. Design a counter using JK – flip flops whose counting sequence is 000, 001, 100, 110, 111,101, 000 etc. by obtaining its minimal sum equations. **(08 Marks)**

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

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 mesh method of analysis. **(06 Marks)**

b. Calculate the power delivered by the source in the circuit, shown in Fig. Q 1(b) using node method. **(14 Marks)**

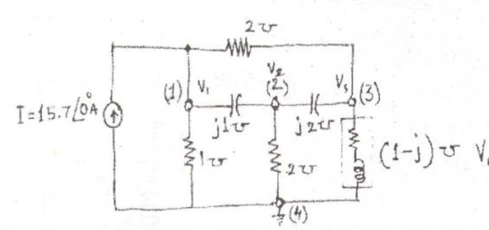

Fig. Q 1(b)

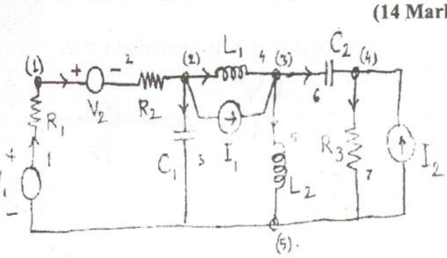

Fig. Q 2(a)

2 a. Obtain the complete incidence matrix for the network shown in Fig. Q 2(a) after writing its graph and oriented graph. **(05 Marks)**

b. For the network shown in Fig. Q 2(b) write the tie set schedule, tie set matrix and obtain equilibrium equation in matrix form using KVL, calculate loop currents. Follow the same orientation and branch numbering as shown in Fig. Q 2(b). Use branches 4, 5 and 6 as tree branches. **(15 Marks)**

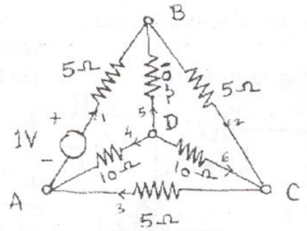

Fig. Q 2(b)

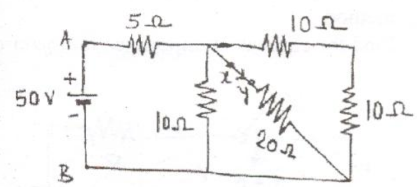

Fig. Q 3(c)

3 a. Define the following theorems.

i) Super position theorem ii) Reciprocity theorem. **(04 Marks)**

b. State and prove Millman's theorem. **(06 Marks)**

c. Show the validity of reciprocity theorem for the following circuit given in Fig. Q 3(c) for AB and XY ports. **(10 Marks)**

4 a. State the following theorems –

i) Norton's theorem ii) Maximum power transfer theorem. **(04 Marks)**

b. State and prove Thevenin's theorem. **(07 Marks)**

c. Find the Thevenin's equivalent circuit of the network shown in Fig. Q 4(b) across load.

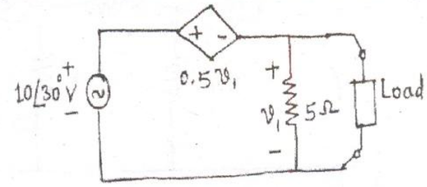

Fig. Q 4(c) **(09 Marks)**

PART - B

5 a. Define the following terms – i) Resonance, ii) A – factor, iii) Selectivity, iv) Band Width. **(04 Marks)**

b. Derive the expression for parallel resonance circuit. Containing resistance in both the branches. **(06 Marks)**

c. A series R L C circuit has R = 10 Ω, L = 0.01 H and C = 0.01 μ F and it is connected across 10 mV supply. Calculate – i) f_0 ii) Q_0 iii) Band Width iv) f_1 and f_2, v) Io. **(10 Marks)**

6 a. Why to study initial conditions? **(03 Marks)**

b. For the network diagram shown in Fig. Q6 (b) find out $i(0^+)$, $\frac{di(0^+)}{dt}$ and $\frac{d^2 i(0^+)}{dt^2}$, take $V_c(0) = 0$ if K is closed at t = 0. **(07 Marks)**

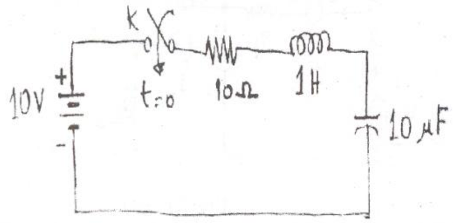

Fig. Q 6(b)

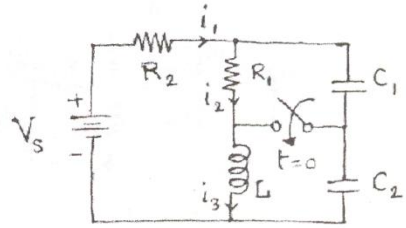

Fig. Q 6(c)

c. Determine the currents at t = (0^+) for the circuit shown in Fig. Q 6(c). **(10 Marks)**

7 a. Define impulse function. Draw diagram of approximate impulse function. Obtain L. T of impulse function. **(05 Marks)**

b. For the circuit shown in Fig. Q 7(b) find out the current i(t) if K is closed at t = 0, use L. T. method. **(05 Marks)**

c. Find the equivalent impedance for the circuit, shown in Fig. Q 7(c) L. T. **(10 Marks)**

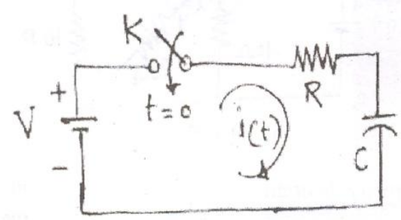

Fig. Q 7(b)

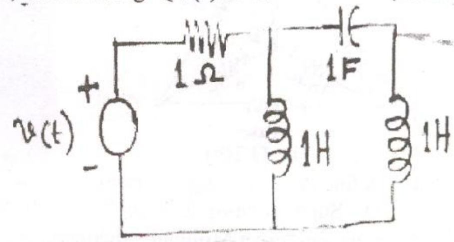

Fig. Q 7(c)

8 a. What is the use of hybrid parameters? Define hybrid parameters. **(05 Marks)**

b. Derive expressions for Y – parameters in terms transmission parameters. **(05 Marks)**

c. For the network shown in Fig. Q 8 (c) obtain the O.C. impedance parameters.

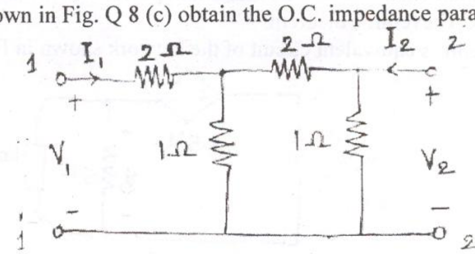

Fig. Q 8(c) **(10 Marks)**

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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)**

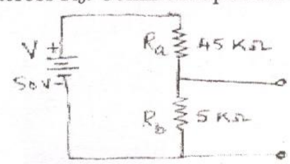

Fig.Q1(b)

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)**

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06ES36

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 $a = 2\times10^{-4}\,\text{s/m}$ 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)**