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10MAT31

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the Fourier series expansion of the function $f(x) = |x|$ in $(-\pi, \pi)$, hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$. **(06 Marks)**

b. Obtain the half-range cosine series for the function, $f(x) = (x-1)^2$ in the interval $0 \le x \le 1$ and hence show that $\pi^2 = 8\left\{\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ...\right\}$ **(07 Marks)**

c. Compute the constant term and first two harmonics of the Fourier series of f(x) given by, **(07 Marks)**

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0

2 a. Obtain the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. **(06 Marks)**

b. 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 evaluate $\int_0^{\infty} \frac{x\cos x - \sin x}{x^3} dx$. **(07 Marks)**

c. Find the inverse Fourier sine transform of $\frac{s}{1+s^2}$. **(07 Marks)**

3 a. Obtain the various possible solutions of two dimensional Laplace's equation, $u_{xx} + u_{yy} = 0$ by the method of separation of variables. **(07 Marks)**

b. Solve the one-dimensional 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) $u(x, 0) = \frac{u_0 x}{l}$ where u_0 is constant (iii) $\frac{\partial u}{\partial t}(x,0) = 0$. **(07 Marks)**

c. Obtain the D'Almbert's solution of the wave equation $u_{tt} = C^2 u_{xx}$ subject to the conditions $u(x, 0) = f(x)$ and $\frac{\partial u}{\partial t}(x,0) = 0$. **(06 Marks)**

4 a. Find the best values of a, b, c, if the equation $y = a + bx + cx^2$ is to fit most closely to the following observations. **(07 Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

b. Solve the following by graphical method to maximize $z = 50x + 60y$ subject to the constraints, $2x + 3y \le 1500$, $3x + 2y \le 1500$, $0 \le x \le 400$ and $0 \le y \le 400$. **(06 Marks)**

c. By using Simplex method, maximize $P = 4x_1 - 2x_2 - x_3$ subject to the constraints, $x_1 + x_2 + x_3 \le 3$, $2x_1 + 2x_2 + x_3 \le 4$, $x_1 - x_2 \le 0$, $x_1 \ge 0$ and $x_2 \ge 0$. **(07 Marks)**

PART – B

5 a. Using Newton-Raphson method, find a real root of $x\sin x + \cos x = 0$ nearer to π, carryout three iterations upto 4-decimals places. **(07 Marks)**

b. Find the largest eigen value and the corresponding eigen vector of the matrix,

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

By using the power method by taking the initial vector as $[1\ 1\ 1]^T$ carryout 5-iterations. **(07 Marks)**

c. Solve the following system of equations by Relaxation method:
$12x + y + z = 31$; $2x + 8y - z = 24$; $3x + 4y + 10z = 58$ **(06 Marks)**

6 a. A survey conducted in a slum locality reveals the following information as classified below,

Income per day in Rupees 'x'	Under 10	10 – 20	20 – 30	30 – 40	40 – 50
Numbers of persons 'y'	20	45	115	210	115

Estimate the probable number of persons in the income group 20 to 25. **(07 Marks)**

b. Determine f(x) as a polynomials in x for the data given below by using the Newton's divided difference formula. **(07 Marks)**

x	2	4	5	6	8	10
f(x)	10	96	196	350	868	1746

c. Evaluate $\int_0^1 \frac{x}{1+x^2}dx$ by using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule by taking 6 – equal strips and hence deduce an approximate value of $\log_e 2$. **(06 Marks)**

7 a. Solve the wave equation, $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$, subject to u(0, t) = 0, u(4, t) = 0, $u_t(x, 0) = 0$ and $u(x, 0) = x(4 - x)$ by taking h = 1, K = 0.5 upto 4-steps. **(07 Marks)**

b. Solve numerically the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions, u(0, t) = 0 = u(1, t), $t \geq 0$ and $u(x, 0) = \sin \pi x$, $0 \leq x \leq 1$, carryout the computation for two levels taking $h = \frac{1}{3}$ and $K = \frac{1}{36}$. **(07 Marks)**

c. Solve $u_{xx} + u_{yy} = 0$ in the following square region with the boundary conditions as indicated in the Fig. Q7 (c). **(06 Marks)**

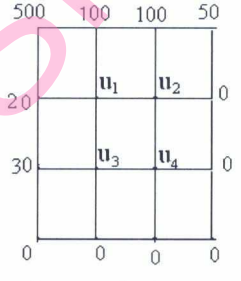

Fig. Q7 (c)

8 a. Find the z-transform of, (i) $\sinh n\theta$ (ii) $\cosh n\theta$ (iii) n^2 **(07 Marks)**

b. Find the inverse z-transform of, $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(06 Marks)**

c. Solve the difference equation, $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ by using z-transform. **(07 Marks)**

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10ES32

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

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

PART – A

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

b. Explain the working of bridge rectifier. **(08 Marks)**

c. Design a suitable circuit represented by the box shown below which has input and output waveforms as indicated. **(06 Marks)**

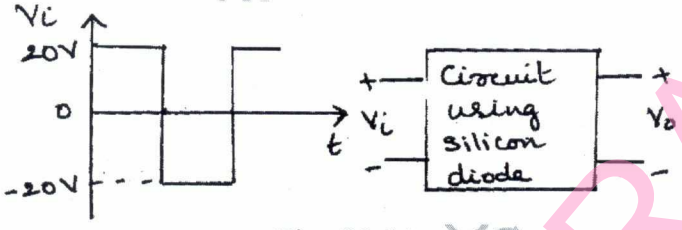


Fig. Q1 (c)

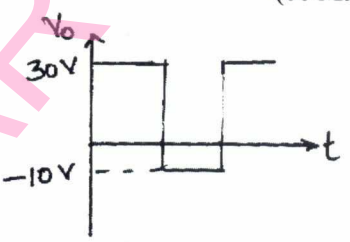


Fig. Q1 (c) – (ii)

2 a. Derive an expression for I_B, I_C and V_{CE} for voltage divider bias using exact analysis. **(10 Marks)**

b. For the circuit shown below, determine (i) I_B (ii) I_C (iii) V_{CE}. **(06 Marks)**

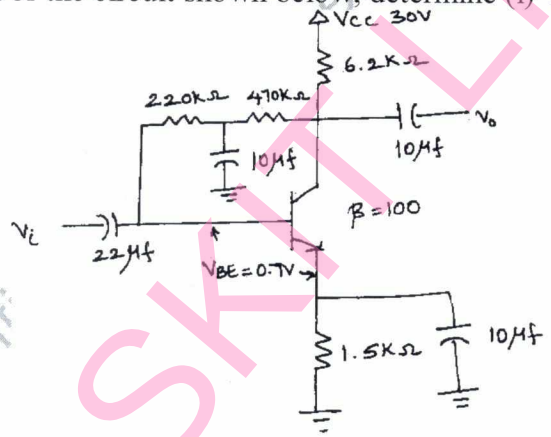


Fig. Q2 (b)

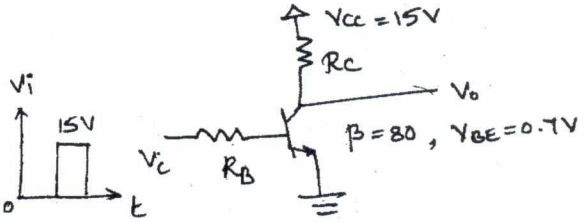


Fig. Q2 (c)

c. Determine R_B and R_C for the transistor inverter of Fig. Q2 (c) if $I_{C(Sat)}$ = 10 mA, I_B = 150% $I_{B(max)}$. **(04 Marks)**

3 a. Derive an expression for A_V, Z_i and Z_O for CE fixed bias using r_e equivalent model. **(10 Marks)**

3 b. For the circuit shown in Fig. Q3 (b), calculate re, Z_i, Z_O, A_V, A_I. **(10 Marks)**

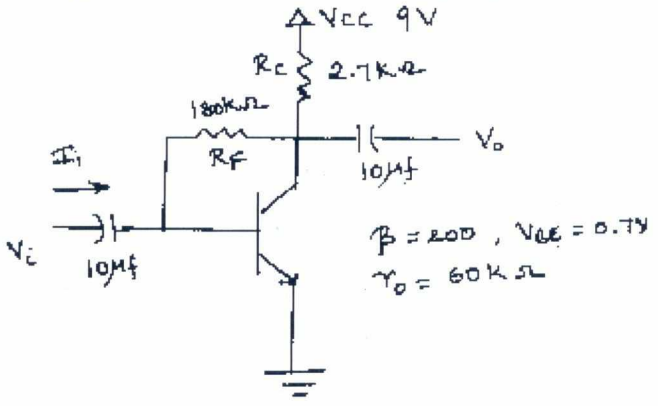


Fig. Q3 (b)

4 a. Determine the lower cut off frequency for the emitter follower using BJT amplifier with C_S = 0.1 μf, R_S = 1 KΩ, R_1 = 120 KΩ, R_L = 4 KΩ, R_E = 1.5 KΩ, C_C = 0.1 μf, β = 100, $r_0 = \infty$, V_{CC} = 15 V, V_{BE} = 0.7 V. **(12 Marks)**

b. Derive equations for Miller input and output capacitance. **(08 Marks)**

PART – B

5 a. Derive an expression for Z_i, A_V, A_I for Darlington emitter follower circuit. **(10 Marks)**

b. What are the effects of negative feedback in amplifier? Show how bandwidth of an amplifier increases with negative feedback. **(10 Marks)**

6 a. With a neat diagram explain the working of complementary symmetry push pull amplifier. **(10 Marks)**

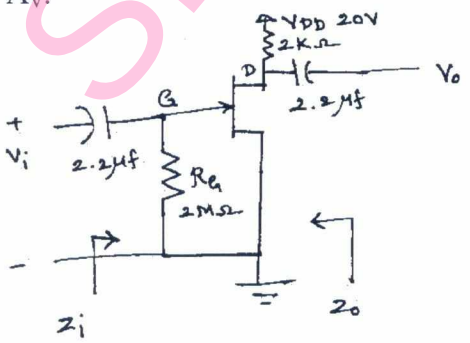
b. Explain the operation of class B push pull amplifier and show that its efficiency is 78.5% at maximum power dissipation. **(10 Marks)**

7 a. With a neat diagram, explain the working of RC phase shift oscillator. **(08 Marks)**

b. With a neat diagram, explain the working of series resonant crystal oscillator. A crystal has L = 0.334 H, C = 0.065 pf, C_M = 1 pf, R = 5.5 kΩ. Calculate its series and parallel resonating frequency. **(12 Marks)**

8 a. Draw the JFET amplifier using fixed bias configuration. Derive Zi, ZO and AV using small signal model. **(10 Marks)**

b. For the JFET amplifier shown in Fig. Q3 (b), calculate (i) g_m (ii) r_d (iii) Z_i (iv) Z_0 (v) A_V. **(10 Marks)**



I_{PSS} = 5 mA
V_P = - 6 V
Y_{OS} = 40 μs

Fig. Q8 (b)

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10ES33

Third Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Design a three –input, one – output minimal tow-level gate combinational circuit which has an output equal to 1 when majority of its inputs are at logic 1 and has an output equal to 0 when majority of its inputs are at logic 0. **(08 Marks)**

b. Minimize the expression :
$\overline{Y} = \overline{A}\,B\,\overline{C}\,\overline{D} + \overline{A}\,B\,\overline{C}\,D + A\,B\,\overline{C}\,\overline{D} + A\,B\,\overline{C}\,D + A\,\overline{B}\,\overline{C}\,D + \overline{A}\,\overline{B}\,C\,\overline{D}$. **(06 Marks)**

c. Reduce the following function using K – Map technique
$f(A, B, C, D) = \pi M(0, 3, 4, 7, 8, 10, 12, 14) + d(2, 6)$. **(06 Marks)**

2 a. Obtain all the prime implicants of the following Boolean function using Quine – Mccluskey method.
$f(a, b, c, d) = \Sigma(0, 2, 3, 5, 8, 10, 11)$
verify the result using k – Map technique. **(10 Marks)**

b. Simplify the given function using MEV technique taking the least significant variable as the map entered variable
$f(a, b, c, d, e) = \Sigma(1, 3, 4, 6, 9, 11, 12, 14, 17, 19, 20, 22, 25, 27, 28, 30) + \Sigma d(8, 10, 24, 26)$. **(10 Marks)**

3 a. Implement the multiple functions :
$f_1(a, b, c, d) = \Sigma(0, 4, 8, 10, 14, 15)$ and
$f_2(a, b, c, d) = \Sigma(3, 7, 9, 13)$ using two 3 to 8 decoders. **(06 Marks)**

b. Implement the following with a suitable decoder with active low enable input and active high output :
$f(w, x, y, z) = \Sigma(3, 7, 9)$
$g(a, b, c) = \pi(2, 4, 7)$. **(08 Marks)**

c. Draw the interfacing diagram of ten key keypad interface to a digital system using decimal to BCD encoder. **(06 Marks)**

4 a. Configure a 16 to 1 MUX using 4 to 1 MUX. **(06 Marks)**

b. Implement the following Boolean function with 8 : 1 multiplexer
$f(A, B, C, D) = \Sigma_m(0, 2, 6, 10, 11, 12, 13) + d(3, 8, 14)$. **(06 Marks)**

c. Write a truth table for two – bit magnitude comparator. Write the K – Map for each output of two – bit magnitude comparator and the resulting equation. **(08 Marks)**

PART – B

5 a. What do you mean by sequential circuit? Explain with the help of block diagram? **(04 Marks)**

b. Explain with timing diagram, the working of SR latch as a switch debouncer. **(06 Marks)**

c. Explain the working of a master – slave JK flip-flop with the help of logic diagram, function table, logic symbol and timing diagram. **(10 Marks)**

6 a. Obtain the characteristic equation for a SR flip-flop. **(04 Marks)**

b. Design a 4-bit register using positive edge triggered D flip-flops to operate as indicated in the table below : **(08 Marks)**

Mode select		Register operation
a_1	a_0	
0	0	Hold
0	1	Synchronous clear
1	0	Complement contents
1	1	Circular shift right

c. Design a synchronous Mod – 6 counter using JK flip – flop. **(08 Marks)**

7 a. Explain mealy and Moore models of a clocked synchronous sequential circuits. **(08 Marks)**

b. Analyse the synchronous sequential circuit shown in Fig. Q7(b). **(12 Marks)**

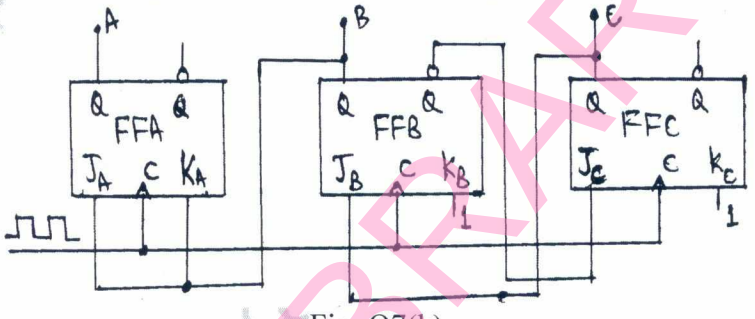

Fig. Q7(b)

8 a. Write the basic recommended steps for design of a clocked synchronous sequential circuit. **(06 Marks)**

b. Construct the excitation table, transition table, state table and state diagram for the Moore sequential circuit shown in Fig. Q8(b). **(14 Marks)**

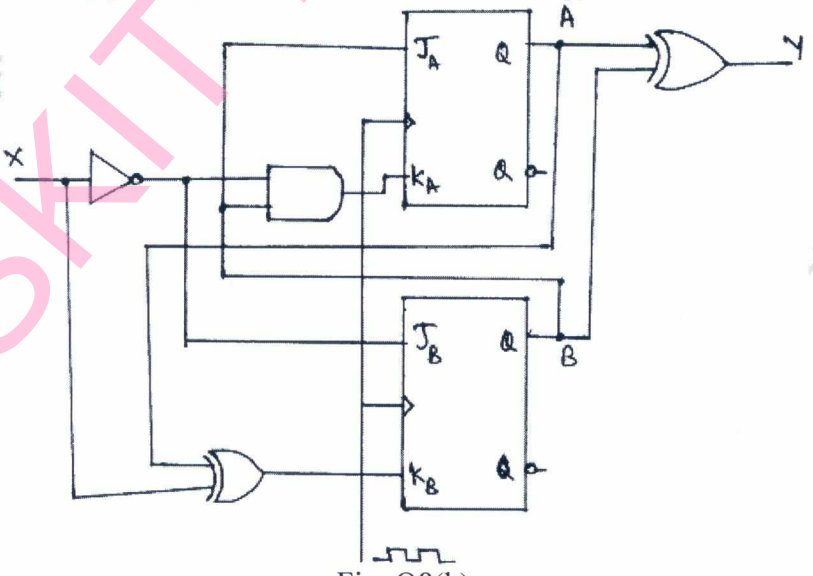

Fig. Q8(b)

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10ES34

Third Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Network Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the equivalent resistance at AB using Y - Δ transformation technique for the circuit shown in Fig. Q1(a). (All the resistors connected are 30 Ω each). **(05 Marks)**

b. Find 'i_x' and 'v_x' for the circuit shown in Fig. Q1(b) by Mesh analysis. **(05 Marks)**

c. For the network given in Fig. Q1(c), find 'I_0' using nodal analysis. **(10 Marks)**

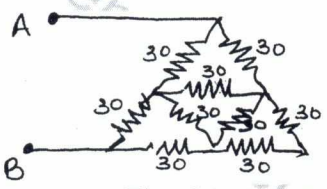

Fig. Q1(a)

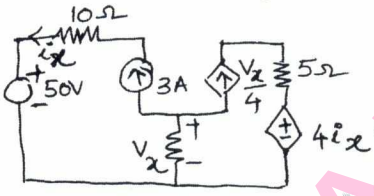

Fig. Q1(b)

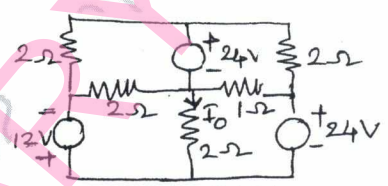

Fig. Q1(c)

2 a. Write the tie – set schedule for the network shown in Fig. Q2(a), and using the tie set schedule determine all branch currents. (Take inner resistors as tree branch elements). **(10 Marks)**

b. For the network shown in Fig. Q2(b), draw the dual circuit. Also write the nodal equations for the dual circuit. **(10 Marks)**

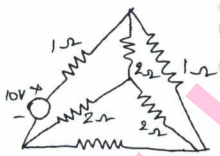

Fig. Q2(a)

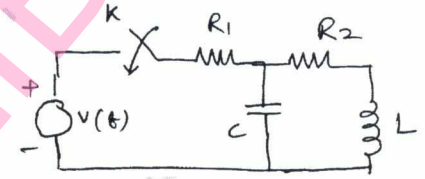

Fig. Q2(b)

3 a. Find the voltage 'V' across 3Ω resistor using superposition theorems for the circuit sown in the Fig. Q3(a). **(10 Marks)**

b. State Millman's theorem. Using Millman's theorem find current through the load resistor R_L for the circuit shown in Fig .Q3(b). **(10 Marks)**

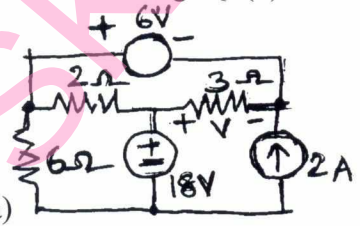

Fig. Q3(a)

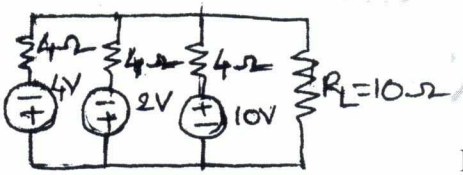

Fig. 3(b)

4 a. Find the Thevenin's equivalent of the network shown in Fig. Q4(a). **(10 Marks)**

b. State maximum power transfer theorem. For the circuit shown in Fig. Q4(b), what should be the value of 'R' such that maximum power transfer can take place from the rest of the network to 'R'. Obtain the amount of this power. **(10 Marks)**

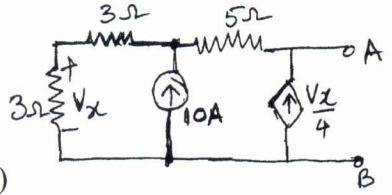

Fig.Q4(a)

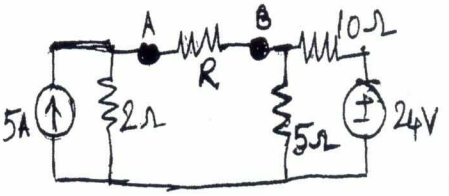

Fig.Q4(b)

PART – B

5 a. A 220 V, 100 Hz AC source supplies a series RLC circuit with a capacitor and a coil. If the coil has 50 m Ω resistance and 5 mH inductance, find at a resonance frequency of 100 Hz what is the value of capacitor. Also calculate the Q factor and half power frequencies of the circuit. **(10 Marks)**

b. Find the value of R_1 such that the circuit given in Fig. Q5(b) is resonant. **(06 Marks)**

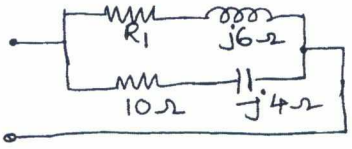

Fig. Q5(b)

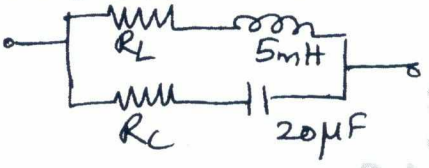

Fig. Q5(c)

c. Determine R_L and R_C that causes the circuit to be resonant at all frequencies for the circuit shown in Fig. Q5(c). **(04 Marks)**

6 a. In the network shown in Fig. Q6(a) the switch is closed at t = 0. Determine i, $\frac{d_i}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = o^+$. **(10 Marks)**

b. For the circuit shown in Fig. Q6(b), the switch 'K' is changed from position – 1 to position – 2 at t = 0 steady – state condition having been reached at position – 1. Find the values of i, $\frac{d_i}{dt}, \frac{d^2i}{dt^2}$ at $t = 0^+$. **(10 Marks)**

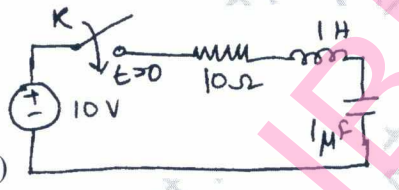

Fig. Q6(a)

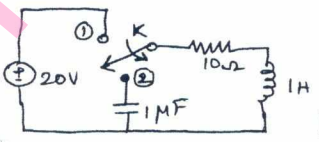

Fig. Q6(b)

7 a. In the Fig. Q7(a), the battery voltage '10'V is applied for a steady state period with switch 'K' open. Obtain the complete expression for the current after closing the switch K. Use Laplace transforms. **(10 Marks)**

b. Referring to the Fig. Q7(b), solve for $i_L(t)$, using Laplace transformation. **(10 Marks)**

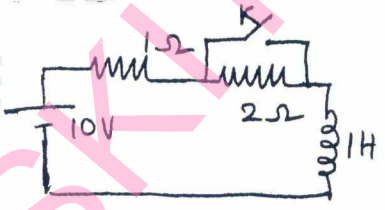

Fig.Q7(a)

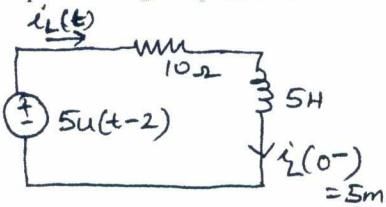

Fig.Q7(b)

8 a. Find the 'z' parameters of the circuit shown in Fig. Q8(a). **(10 Marks)**

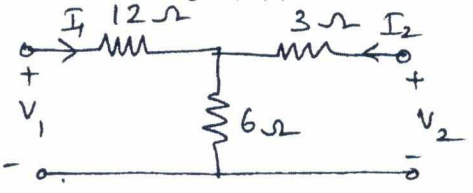

Fig. Q8(a)

b. Following are the hybrid parameters for a network

$$\begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ 3 & 6 \end{bmatrix}.$$

Determine the Y parameters for the network. **(10 Marks)**

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10IT35

Third Semester B.E. Degree Examination, Dec.2013 / Jan. 2014
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following terms as applied to an instrument : i) Accuracy and Precision ii) Random error iii) Absolute and relative error iv) Gross error v) Systematic error. **(06 Marks)**

b. Determine the value of the multiplier resistance on the 50V range of a dc voltmeter that uses a 250μA meter movement with an internal resistance of 100Ω. **(06 Marks)**

c. Explain in detail the working of true RMS volt meter and give the difference between peak responding and average responding voltmeters. **(08 Marks)**

2 a. Explain in detail the working of successive approximation type digital voltmeter and give the O/P for 4 bit control word. **(08 Marks)**

b. A 4½ digit DUM is used for voltage measurements, i) Find its resolution ii) How would 67.50V be displayed on a 5V range iii) How would 0.716V be displayed on 1V and 10V ranges. **(06 Marks)**

c. Explain in detail the working of digital multimeter. **(06 Marks)**

3 a. Explain in detail the generation of time base signal for the horizontal deflecting plates. **(05 Marks)**

b. What is an electronic switch and explain in detail its various modes of operation? **(05 Marks)**

c. List the various control knobs on the front panel of CRO. **(04 Marks)**

d. An electrically deflected CRT has a final anode voltage of 2000V and parallel deflecting plates 1.5cm apart. If the screen is 50cm from the center of the deflecting plates, find i) Beam speed ii) Deflection sensitivity of the tube iii) Deflection factor. **(06 Marks)**

4 a. Explain in detail the working of sampling oscilloscope, with necessary waveforms. **(10 Marks)**

b. Explain in detail the working of digital storage oscilloscope and list the advantages of DSO. **(10 Marks)**

PART – B

5 a. Explain in detail the working of function generator. **(08 Marks)**

b. Explain in detail the working of square and pulse generator. **(08 Marks)**

c. Explain in detail the working of sine and square wave generator. **(04 Marks)**

6 a. Explain in detail the working of wien bridge oscillator and find the parallel 'R' and 'C' that causes a wien bridge to null with the following components values. **(12 Marks)**
$R_1 = 2.7k\Omega$, $R_2 = 22K\Omega$, $C_1 = 5\mu F$, $R_4 = 100k\Omega$ and the operating frequency is 2.2KHz.

b. For the wheat stone bridge shown in fig. Q6(b), the galvanometer has a current sensitivity of 12mm/μA. The internal resistance of galvanometer is 200Ω. Calculate the deflection of the galvanometer caused due to 5Ω unbalance in the arm AD. **(08 Marks)**

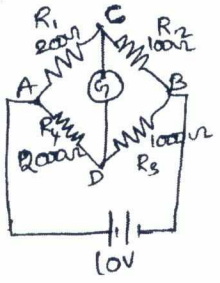

Fig.Q6(b)

7 a. Explain in detail the working of resistive position transducer and also calculate the output voltage when wiper is 10cm from extreme end for the applied voltage of 5V and if the resistive position transducer uses a shaft with a stroke of 50cm. The total resistance of the potentiometer is 5kΩ. **(10 Marks)**

b. Explain the construction, principle and operation of LVDT. **(10 Marks)**

8 a. Write a short note on signal conditioning system. **(06 Marks)**

b. Explain the working of piezo electric transducer with circuit diagram. **(10 Marks)**

c. Compare LED displays and LCD displays. **(04 Marks)**

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10ES36

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014
Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain the Coulomb's law of force between the two point charges. **(05 Marks)**

b. Four 10nc positive charges are located in the Z = 0 plane at the corners of a square of side 8cm. A fifth 10nc positive charge is located at a point 8cm distant from the other charges. Calculate the magnitude of the force on the fifth charge in free space. **(07 Marks)**

c. A 100nc point charge is located at A(-1, 1, 3) in free space.
   i) Find the locus of all points P(x, y, z) at which E_x = 500 V/m.
   ii) Find y_1 it P(-2, y_1, 3) lies on that locus. **(08 Marks)**

2 a. Determine the work done in carrying a charge of 2C from B(1, 0, 1) to A(0.8, 0.6, 1) in an-electric field $\vec{E} = y\hat{a}_y + x\hat{a}_y + 2\hat{a}_z$ V/mt along the short arc of circle $x^2 + y^2 = 1$, Z = 1. **(06 Marks)**

b. Show that electric field intensity is a negative potential gradient. **(04 Marks)**

c. Derive an expression for continuity equation in point form. **(04 Marks)**

c. The Z = 0 defines the boundary between free space and dielectric medium with dielectric constant 20. The electric field intensity in free space is $\vec{E} = 10\hat{a}_x + 20\hat{a}_y + 40\hat{a}_z$ V/mt. Determine the electric field intensity in the dielectric medium. **(06 Marks)**

3 a. Derive Poisson's and Laplace's equation. **(06 Marks)**

b. In free space the volume charge density $\rho_v = \frac{200\epsilon_0}{r^{2.4}} C/m^3$, use Poisson's equation to find the potential V(r). **(08 Marks)**

c. Using Laplace's equation derive an expression for capacitance of parallel plate capacitor. **(06 Marks)**

4 a. State and explain Biot-Savart law. **(06 Marks)**

b. Prove that Ampere's circular law $\vec{\nabla} \times \vec{H} = \vec{J}$. **(07 Marks)**

c. Determine the magnetic field intensity $\vec{H}$ at point P(0.4, 0.3, 0). If the 8A current in a conductor inward from ∞ to orgin on the x-axis and outward to ∞ along y-axis. **(07 Marks)**

PART – B

5 a. Deduce the expression for force between the differential current elements. **(10 Marks)**

b. A loop has a dimension of 1mt × 2mt and lies in the uniform magnetic field $\vec{B}_0 = -0.6\hat{a}_y + 0.8\hat{a}_z$ T. The loop current is 4mA. Calculate the torque on the loop. **(10 Marks)**

6 a. Using Faraday's law derive an expression for emf induced in a stationary conductor placed in a time varying magnetic field. **(04 Marks)**

b. In a certain dielectric media the relative permittivity $\epsilon_r = 5$, conductivity $\sigma = 0$, the displacement current density $\vec{J}_d = 20\cos(1.5\times10^8 t - bx)\hat{a}y \ \mu A/m^2$. Determine the electric flux density and electric field intensity. **(06 Marks)**

c. Show that, in a capacitor the conduction current density is equal to displacement current density for the applied voltage of $v(t) = v_0 \cos wt$. **(10 Marks)**

7 a. Using Maxwell's equation derive an expression for uniform plane wave in free space. **(08 Marks)**

b. Derive an expression for propagation constant, intrinsic impedance and phase velocity in good conducting media if the uniform plane wave is propagating. **(06 Marks)**

c. The $\vec{H}$ field in free space is given by $\vec{H}(x,t) = 10\cos(10^8 t - \beta x)\hat{a}y \ A/mt$. Find β, λ and E(x, t) at P(0.1, 0.2, 0.3) and t = 1ns. **(06 Marks)**

8 a. Derive an expression for reflection and transmission coefficient if the uniform plane wave incident normally at the boundary with different dielectric. **(10 Marks)**

b. Write a short note on Poynting theorem. **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Express the complex number $\frac{(1+i)(1+3i)}{1+5i}$ in the form x + iy. **(06 Marks)**

b. Find the modulus and amplitude of $\frac{(3-\sqrt{2i})^2}{1+2i}$. **(07 Marks)**

c. Expand $\cos^8\theta$ in a series of cosines multiples of θ. **(07 Marks)**

2 a. Find the n^{th} derivative of sin(ax + b). **(06 Marks)**

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

c. Find the nth derivative of $\left[\frac{1}{5(x-1)} + \frac{-3/2}{\left(\frac{-3}{2}-1\right)(2x+3)}\right]$. **(07 Marks)**

3 a. Using Taylor's theorem, express the polynomial $2x^3 + 7x^2 + x - 6$ in powers of (x – 1). **(06 Marks)**

b. Using Maclaurin's series, expand tan x upto the term containing x^5. **(07 Marks)**

c. If $Z = x^3 + y^3 - 3axy$ then prove that $\frac{\partial^2 z}{\partial y \partial x} = \frac{\partial^2 z}{\partial x \partial y}$. **(07 Marks)**

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

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

c. If $u = x + 3y^2 - z^3$, $v = 4x^2yz$, $w = 2z^2 - xy$, find the value of $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ at (1, –1, 0). **(07 Marks)**

5 a. Obtain the reduction formula for $\int \sin^n x\, dx$. **(06 Marks)**

b. Evaluate $\int_0^a \frac{x^7 dx}{\sqrt{a^2 - x^2}}$. **(07 Marks)**

c. Evaluate $\int_1^2 \int_3^4 (xy + e^y) dy dx$. **(07 Marks)**

6 a. Evaluate $\int_0^1 \int_0^1 \int_0^1 e^{x+y+z} dx dy dz$. **(06 Marks)**

b. Find the value of $\left|\overline{\left(\frac{1}{2}\right)}\right.$. **(07 Marks)**

c. Prove that $\beta(m,n) = \frac{\overline{|(m)}\,\overline{|(n)}}{\overline{|(m+n)}}$. **(07 Marks)**

7 a. Solve $\frac{dy}{dx} = e^{3x-2y} + x^2 \cdot e^{-2y}$. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \frac{x^2 - y^2}{xy}$ which is homogeneous in x and y. **(07 Marks)**

c. Solve $\frac{dy}{dx} - \frac{y}{x+1} = e^{3x}(x+1)$. **(07 Marks)**

8 a. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^x$. **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \sin 2x$. **(07 Marks)**

c. Solve $(D^2 - 1)y = x \sin 3x + \cos x$. **(07 Marks)**

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