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10MAT31

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. For the function :

$$f(x) = \begin{cases} x & \text{in} \quad 0 < x < \pi \\ x - 2\pi & \text{in} \quad \pi < x < 2\pi \end{cases}$$

Find the Fourier series expansion and hence deduce the result $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - - - - - - -.$ **(07 Marks)**

b. Obtain the half range Fourier cosine series of the function $f(x) = x(\ell - x)$ in $0 \le x \le \ell$. **(06 Marks)**

c. Find the constant term and first harmonic term in the Fourier expansion of y from the following table :

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

(07 Marks)

2 a. Find the Fourier transform of the function :

$$f(x) = \begin{cases} 1 & \text{for} \quad |x| \le a \\ 0 & \text{for} \quad |x| > a \end{cases}$$ and hence evaluate : $\int_0^\infty \frac{\sin x}{x} dx$. **(07 Marks)**

b. Obtain the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1 + x^2} dx, m > 0.$ **(06 Marks)**

c. Solve the integral equation : $\int_0^\infty f(x) \cos px dx = \begin{cases} 1 - p, & 0 \le p \le 1 \\ 0, & p > 1 \end{cases}$ and hence deduce the value of $\int_0^\infty \frac{\sin^2 t}{t^2} dt$. **(07 Marks)**

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

b. A string is stretched and fastened to two points 'ℓ' apart. Motion is started by displacing the string in the form $y = a \sin\left(\frac{\pi x}{\ell}\right)$ from which it is released at time t = 0. Show that the displacement of any point at a distance 'x' from one end at time 't' is given by $y(x, t) = a \sin\left(\frac{\pi x}{\ell}\right) \cos\left(\frac{\pi ct}{\ell}\right)$. **(06 Marks)**

c. Obtain the D' Alembert's solution of the wave equation $u_{tt} = c^2 u_{xx}$ subject to the conditions $u(x, 0) = f(x)$ and $\frac{\partial u}{\partial t}(x,0) = a$. **(07 Marks)**

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.

4 a. For the following data fit an exponential curve of the form $y = a\,e^{bx}$ by the method of least squares :

x	5	6	7	8	9	10
y	133	55	23	7	2	2

(07 Marks)

b. Solve the following LPP graphically :
Minimize $Z = 20x + 10y$
Subject to the constraints : $x + 2y \le 40$
$3x + y \ge 30$
$4x + 3y \ge 60$
$x \ge 0$ and $y \ge 0$. (06 Marks)

c. Using Simplex method, solve the following LPP :
Maximize : $Z = 2x + 4y$
Subject to the constraints $3x + y \le 22$
$2x + 3y \le 24$
$x \ge 0$ and $y \ge 0$. (07 Marks)

PART – B

5 a. Using the Regula – Falsi method to find the fourth root of 12 correct to three decimal places. (07 Marks)

b. Apply Gauss – Seidal method, to solve the following of equations correct to three decimal places :
$6x + 15y + 2z = 72$
$x + y + 54z = 110$
$27x + 6y - z = 8.5$
(carry out 3 iterations). (06 Marks)

c. Using Rayleigh power method, determine the largest eigen value and the corresponding eigen vector, of the matrix A in six iterations. Choose $[1\ 1\ 1]^T$ as the initial eigen vector :

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}.$$ (07 Marks)

6 a. Using suitable interpolation formulae, find y(38) and y(85) for the following data :

x	40	50	60	70	80	90
y	184	204	226	250	276	304

(07 Marks)

b. If $y(0) = -12$, $y(1) = 0$, $y(3) = 6$ and $y(4) = 12$, find the Lagrange's interpolation polynomial and estimate y at $x = 2$. (06 Marks)

c. By applying Weddle's rule, evaluate : $\int_0^1 \frac{x\,dx}{1+x^2}$ by considering seven ordinates. Hence find the value of $\log_e^2$. (07 Marks)

7 a. Using finite difference equation, solve $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = u(4, t) = 0$, $u_t(x, 0) = 0$ and $u(x, 0) = x(4 - x)$ upto four time steps. Choose $h = 1$ and $k = 0.5$. **(07 Marks)**

b. Solve the equation $u_t = u_{xx}$ subject to the conditions $u(0, t) = 0$, $u(1, t) = 0$, $u(x, 0) = \sin(\pi x)$ for $0 \le t \le 0.1$ by taking $h = 0.2$. **(06 Marks)**

c. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown. Find the first iterative values of $u_i (i = 1 - 9)$ to the nearest integer. **(07 Marks)**

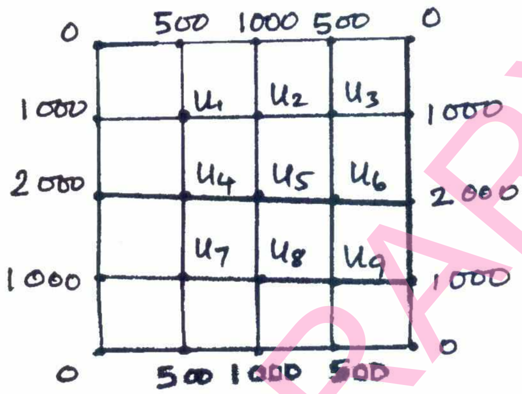

Fig.Q7(c)

8 a. Find the z – transform of $2n + \sin(n\pi/4) + 1$. **(07 Marks)**

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

c. Using z – transform, solve the following difference equation :
$u_{n+2} + 2u_{n+1} + u_n = n$ with $u_0 = u_1 = 0$. **(07 Marks)**

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Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Analog Electronic Circuit

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With necessary equivalent circuit, explain the various diode equivalent circuits. **(06 Marks)**

b. What do you understand by reverse recovery time? Explain its importance in selection of a diode for an application. **(06 Marks)**

c. For the diode circuit shown in Fig. Q1(c) draw the transfer characteristics. The input is 40 sin ωt. Show clearly the steps of analysis. All diodes are ideal. **(08 Marks)**

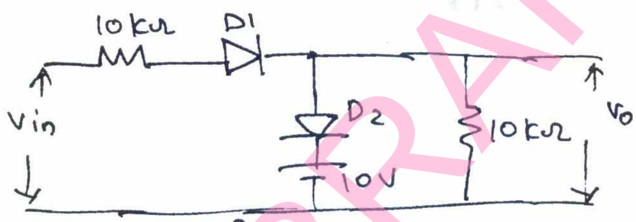

Fig.Q1(c)

2 a. Discuss the effect of varying I_B and V_{CC} on the Q – point. Explain your answer with relevant diagram. **(06 Marks)**

b. An emitter bias circuit has R_C = 2 kΩ, R_E = 680 Ω, V_E = 2.1V, V_{CE} = 7.3V, I_B = 20 μA. Find V_{CC}, R_B and β. **(06 Marks)**

c. A voltage divider biased circuit has R_1 = 39 kΩ, R_2 = 8.2 kΩ, R_C = 3.3 kΩ, R_E = 1 kΩ, V_{CC} = 18V. The silicon transistor used has β = 120. Find Q – point and stability factor. **(08 Marks)**

3 a. Derive an expression for voltage gain, input impedance and output impedance of an emitter follower amplifier using re-model. **(06 Marks)**

b. A voltage divider biased amplifier has R_1 = 82 kΩ, R_2 = 22 kΩ, R_E = 1 kΩ, R_C = 2.2 kΩ, V_{CC} = 18 V. The silicon transistor has β = 100. Take R_S = 1 kΩ, R_L = 5.6 kΩ. Find voltage gain, input impedance, output impedance. **(06 Marks)**

c. A transistor in CE mode has h_{ie} = 1100 Ω, h_{fe} = 100, h_{re} = 2.5×10^{-4}, h_{oe} = 25 μ℧. Find voltage gain, input impedance and output impedance. Take R_S = 1 kΩ, R_L = 1 kΩ. Also find current gain. **(08 Marks)**

4 a. Discuss with relevant equivalent circuit the method of determination of lower cutoff frequency for a voltage divider biased CE amplifier. **(10 Marks)**

b. A voltage divider biased CE amplifier has R_S = 1 k Ω, R_1 = 40 kΩ, R_2 = 10 kΩ, R_E = 2 kΩ, R_C = 2.2 kΩ, C_S = 10 μF, C_C = 1 μF, C_E = 20 μF, β = 100, V_{CC} = 20. The parasitic capacitance are $C_\pi(C_{be})$ = 36 pF, $C\mu(C_{bc})$ = 4 pF, C_{ce} = 1 pF, C_{wi} = 6 pF, C_{wo} = 8 pF. Determine higher cutoff frequency. **(10 Marks)**

PART – B

5 a. Obtain expression for voltage gain, input impedance and output impedance of a Darlington emitter follower. Draw necessary equivalent circuit. **(08 Marks)**

b. Mention the different configuration of feedback amplifiers and obtain expression for voltage gain with feedback for any one configuration. **(06 Marks)**

c. What are the advantages of cascading amplifiers? Obtain expression for overall voltage gain for an n – stage cascaded amplifier. **(06 Marks)**

6 a. Prove that the maximum conversion efficiency of class A transformer coupled amplifier is 50%. **(08 Marks)**

b. With neat diagram, explain the methods of obtaining phase shift of input signal for class B operation. **(06 Marks)**

c. The harmonic distortion component in an power amplifier is $D_2 = 0.1$, $D_3 = 0.02$, $D_4 = 0.03$. The fundamental current amplitude is 4 A and it supplies a load of 8 Ω. Find total harmonic distortion, fundamental power and total power. **(06 Marks)**

7 a. What is Barkhansen criteria for sustained oscillation? Explain basic principle of operation of oscillators. **(08 Marks)**

b. With a neat circuit diagram, explain the working of Hartley oscillator. Write the equation for frequency of oscillations. **(08 Marks)**

c. A crystal has mounting capacitance of 10 pF. The inductance equivalent of mass is 1 mH, the frictional resistance = 1 kΩ and compliance = 1 pF. Find series and parallel resonant frequency. **(04 Marks)**

8 a. Obtain the expression for voltage gain, input impedance output impedance for a JFET common source amplifier with self – bias configuration. **(08 Marks)**

b. For the FET amplifier in Fig. Q8(b), find voltage gain, input impedance and output impedance. The FET has I_{DSS}= 15 mA, V_p = –6V, Y_{OS} = 25 μs. **(08 Marks)**

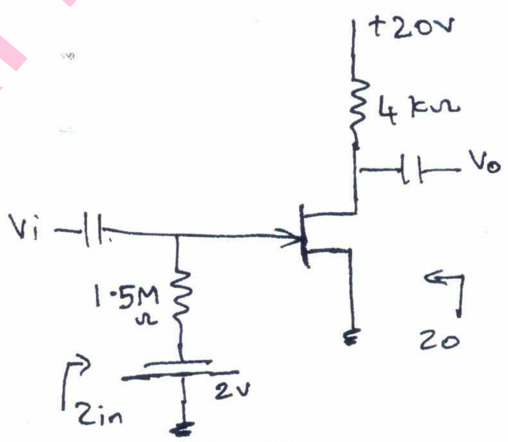

Fig.Q8(b)

c. Mention the difference between BJT and FET. **(04 Marks)**

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10ES33

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define combinational logic. Two motors M_2 and M_1 are controlled by three sensors S_1, S_2 and S_3. One motor M_2 is to run any time when all three sensors are on. The other motor (M_1) is to run whenever sensors S_2 or S_1 but not both are on and S_3 is off. For all sensors combinations where M_1 is on, M_2 is to be off, except when all sensors are off and then both motors remain off. Construct the truth table and write the Boolean output equation. **(05 Marks)**

b. The following Boolean function into their proper canonical form in decimal notation.
i) $M = p(q' + s)$
ii) $N = (w' + x)(y + z)$ **(07 Marks)**

c. Reduce the following Boolean function using K-map and realize the simplified expression using NAND gates.
$T = f(a,b,c,d) = \sum m(1,3,4,5,13,15) + \sum d(8,9,10,11)$ **(08 Marks)**

2 a. Simplify the following function using Quine-McClusky method and realize the simplified using NOR gates.
$P = f(w,x,y,z) = \sum m(7,9,12,13,14,15) + \sum d(4,11)$ **(12 Marks)**

b. Simplify $f(a,b,c,d) = \sum m(0,4,5,6,13,14,15) + \sum d(2,7,8,9)$ using MEV technique using basic gates. **(08 Marks)**

3 a. Design a combinational circuit to find the 9's complement of a single digit BCD number. Realize the circuit using suitable logic gates. **(08 Marks)**

b. Draw the logic diagram for 2 to 4 line decoder with an active low encoder enable and active high data output. Construct a truth table and describe the circuit function with logic symbol (74139IC's) for the decoder. **(06 Marks)**

c. Design a 4 to 16 line decoder using 2 to 4 line decoder which has the active low outputs and active low enable input. Explain its operation. **(06 Marks)**

4 a. Design a binary full adder using only two input NAND gates. Write a truth table. **(06 Marks)**

b. Implement the following Boolean function using 4 : 1 multiplexer (MUX)
$Y = f(A,B,C,D) = \sum m(0,1,2,4,6,9,12,14)$ **(06 Marks)**

c. Define magnitude comparator. Design a two-bit binary comparator and implement with suitable logic gates. **(08 Marks)**

PART – B

5 a. Discuss the difference between a flip flop and latch. Explain the operation of gated SR latch with a logic diagram, truth table and logic symbol. **(06 Marks)**

b. Explain the working of Master Slave JK flip flops with functional table and timing diagram. Show how race around condition is overcome. **(08 Marks)**

c. Obtain the characteristic equation of JK and SR flipflops. **(06 Marks)**

6 a. Describe the block diagram of a MOD-7 twisted ring counter and explain its operation with the count sequence table and decoding logic used to identify the various states. **(08 Marks)**

b. Design a mod-6 synchronous counter using clocked JK flipflops, the count sequence being 0, 2, 3, 6, 5, 1, 0, 2……. **(12 Marks)**

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

b. Explain 4 bit universal shift Register using 4 : 1 MUX with help of logic diagram. Write a mode control table. **(10 Marks)**

8 a. Describe the following terms with respect to sequential machines:

i) State ii) Present states iii) Next states. **(06 Marks)**

b. A sequential circuit has one input one output. The state diagram is shown in Fig. Q8 (b). Design a sequential circuit with T flip flops. **(14 Marks)**

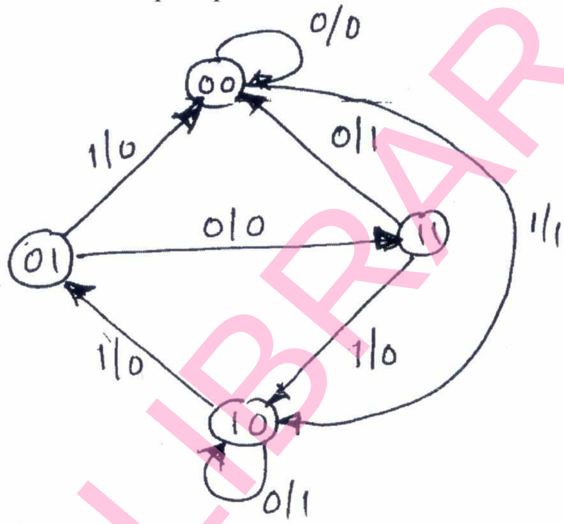

Fig. Q8 (b)

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Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Network Analysis

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 equivalent resistance between the terminals A and B in the network shown in Fig Q1 (a) using Star – Delta transformation. **(06 Marks)**

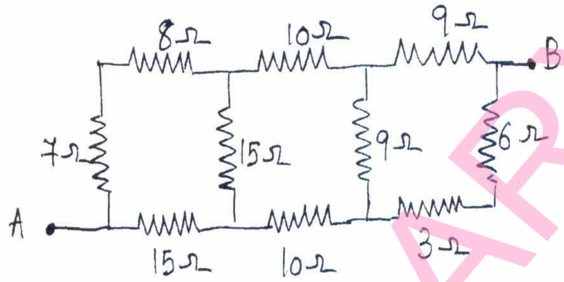


Fig. Q1(a)

b. Find the power delivered by the dependent voltage source in the circuit shown in Fig Q1 (b) by mesh current method. **(06 Marks)**

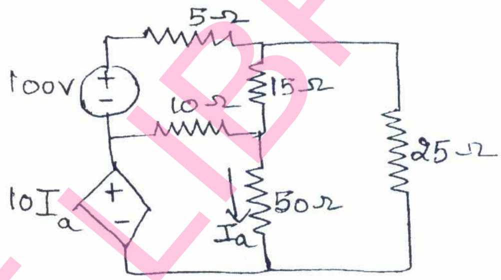


Fig. Q1(b)

c. Find the current i, in the circuit shown in Fig Q1 (c) using Nodal Analysis. **(08 Marks)**

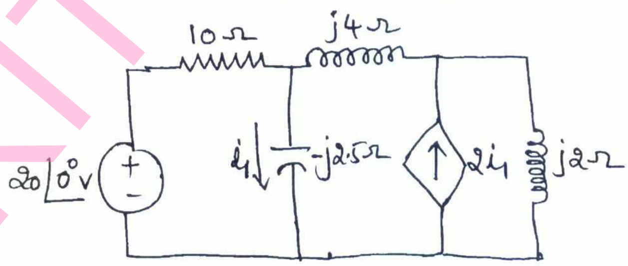


Fig. Q1(c)

2 a. Define the terms tree, cotree, link, cutset schedule and Tie set schedule. **(10 Marks)**

b. Draw the graph of the network shown in Fig Q2 (b). Write the cut set schedule and find all node voltages, branch voltages and branch currents. Assume branches (2) and (3) to form the tree. **(10 Marks)**

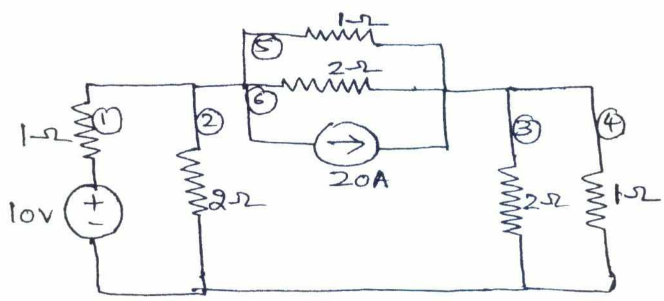
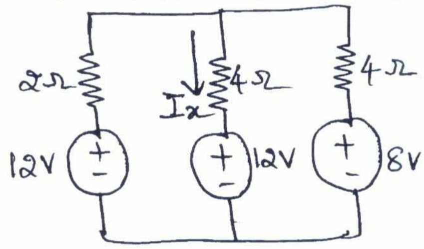


Fig. Q2(b)

3 a. Find I_x for the circuit shown in figure Q3(a) using the principle of superposition. **(06 Marks)**

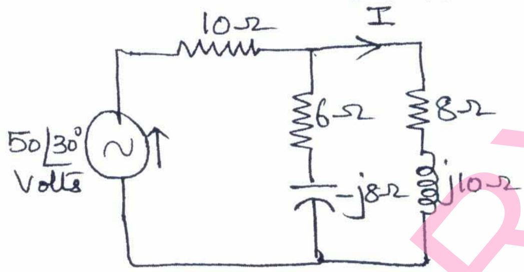
Fig. Q3(a)



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

c. Verify reciprocity theorem for the circuit shown in Fig Q 3(c) with response I. **(08 Marks)**

Fig. Q3(c)



4 a. State and explain the Vinin's theorem. **(06 Marks)**

b. In the circuit shown in Fig Q4(b), find the value of the current through the 667Ω resistor using Norton's theorem. **(06 Marks)**

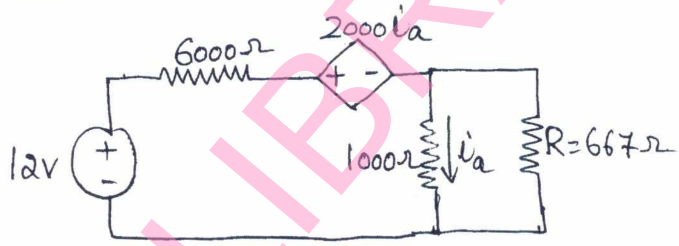
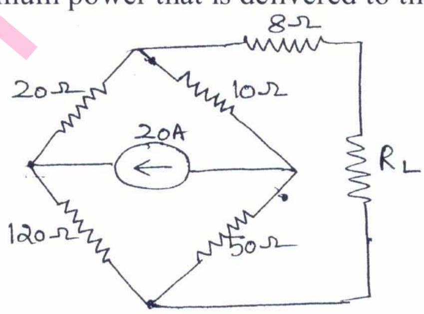


Fig Q4(b)

c. In the circuit shown in Fig Q4(c), find the value of R_L for which maximum power is delivered. Also find the maximum power that is delivered to the load R_L. **(08 Marks)**

Fig. Q4(c)



PART – B

5 a. It is required that a series RLC circuit should resonate at 500KHz. Determine the values of R, L and C if the Bandwidth of the circuit is 10KHz and its impedance is 100Ω at resonance. Also find the voltages across L and C at resonance if the applied voltage is 75 volts. **(10 Marks)**

b. Derive an expression for the resonant frequency of a parallel resonant circuit. Also shown that the circuit is resonant at all frequencies if $R_L = R_C = \sqrt{\frac{L}{C}}$ where R_L = Resistance in the indicator branch, R_C = Resistance in the capacitor branch. **(10 Marks)**

6 a. In the circuit shown in Fig Q6(a), the switch K is changed from position A to B at t = 0, steady state having been leached before switching. Calculate i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(10 Marks)**

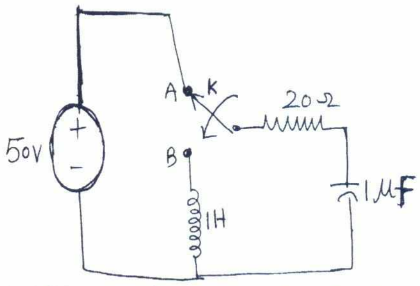


Fig. Q6(a)

b. In the Network shown in Fig Q6(b), steady state is leached with switch K open. The switch is closed at time t = 0. Solve for i_1, i_2, $\frac{di_1}{dt}$ and $\frac{di_2}{dt}$ at $t = 0^+$. **(10 Marks)**

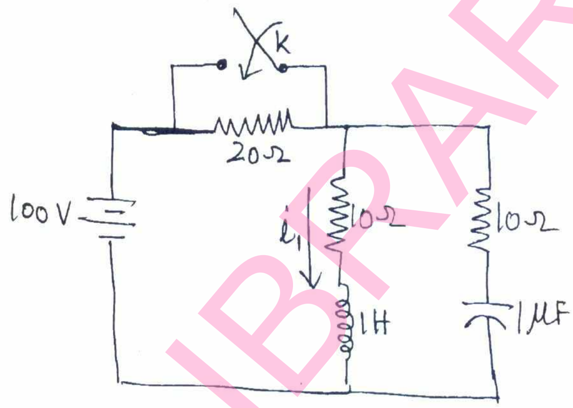


Fig. Q6(b)

7 a. Obtain the Laplace transform of the Periodic signal shown in Fig.Q 7(a) **(10 Marks)**

Fig. Q7(a)

b. Find the convolution of $h(t) = e^{-t}$ and $f(t) = e^{-2t}$. **(04 Marks)**

c. State and prove the initial value theorem. **(06 Marks)**

8 a. Derive Y–parameters and Transmission parameters of a circuit in terms of its z – parameters. **(10 Marks)**

b. Find the z parameters and h – parameters for the circuit shown in Fig. Q8(b) **(10 Marks)**

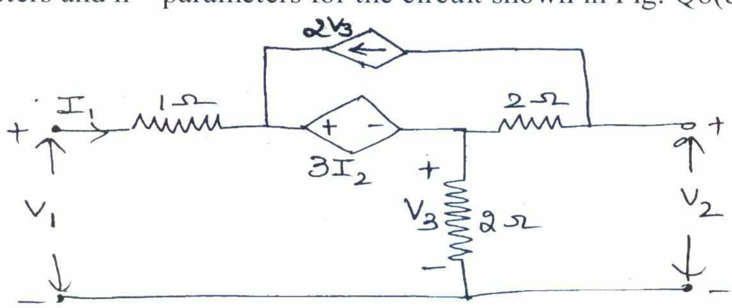


Fig. Q8(b)

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Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
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 following terms as applied to an electronic instruments :
   i) Random error
   ii) Significant figure
   iii) Resolution. **(06 Marks)**

b. Explain the working of a true RMS voltmeter with the help of a suitable block diagram. **(08 Marks)**

c. A component manufacture constructs certain resistance to be anywhere between 1.14 kΩ and 1.26 kΩ and classifies them to be 1.2kΩ resistors. What tolerance be stated? If the resistance values are specified at 25°C and resistor have a temperature coefficient of +500ppm/°C. Calculator the maximum resistance that one of these component might have at 75°C. **(06 Marks)**

2 a. Explain working principle of successive approximation method of DVM. **(08 Marks)**

b. With the help of block diagram, explain the operation of measurement of time. **(06 Marks)**

c. Determine the resolution of a 3½ digit display on 1V and 10 V ranges. **(06 Marks)**

3 a. Explain working of dual trace CRO. **(10 Marks)**

b. Explain triggered sweep CRO. **(05 Marks)**

c. Explain the operation of an electronic switch with the help of a block diagram. **(05 Marks)**

4 a. Explain the working of a digital storage oscilloscope and list the advantages of DSO. **(10 Marks)**

b. Explain the need of time delay in oscilloscopes. **(05 Marks)**

c. Explain the working of sampling oscilloscope. **(05 Marks)**

PART – B

5 a. Explain principles fixed frequency AF oscillator and variable AF oscillator. **(04 Marks)**

b. With a neat block diagram, explain sweep frequency generator. **(08 Marks)**

c. Explain with a neat sketch AF sine and square wave generator. **(08 Marks)**

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.

6 a. Explain Maxwell's bridge. **(08 Marks)**
b. Explain Wagner's earth connection. **(06 Marks)**
c. An unbalanced Wheatstone bridge is given in Fig.Q6(c), calculate the current through the galvanometer. **(06 Marks)**

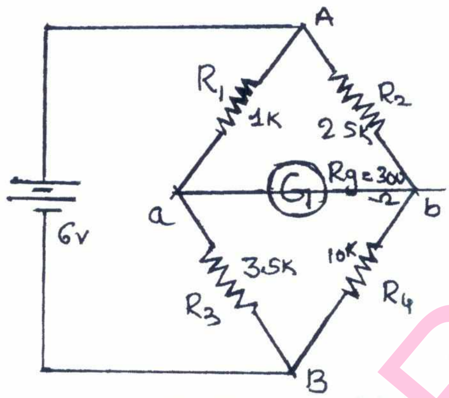

Fig.Q6(c)

7 a. Explain the construction, principle and operation of LVDT. **(08 Marks)**
b. Explain resistance thermometer. **(06 Marks)**
c. Explain thermistor. **(06 Marks)**

8 a. Explain LCD with diagram. **(06 Marks)**
b. Explain power measurement using Bolometer. **(08 Marks)**
c. Write note on signal conditioning system. **(06 Marks)**

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10ES36

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

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. Define electric field intensity $(\vec{E})$. Find an expression for electric field intensity due to N different point charges. **(04 Marks)**

b. Derive Maxwell's first equation in electrostatics. **(04 Marks)**

c. Given $\vec{D} = z \sin\phi \, \vec{ap} + P \sin\phi \, \vec{az}$ c/m^2 compute the volume charge density at (1, 30° 2). **(04 Marks)**

d. Verify both sides of Gauss Divergence theorem if $\vec{D} = 2xy\,\vec{ax} + x^2\,\vec{ay}$ c/m^2 present in the region bounded by $0 \le x \le 1$, $0 \le y \le 2$, $0 \le z \le 3$ **(08 Marks)**

2 a. Derive an equation for potential due to infinite line charge. **(04 Marks)**

b. If $U = \dfrac{60 \sin\theta}{r^2}$ V find V and $\vec{E}$ at P (3,60,25) **(05 Marks)**

c. Derive an equitation for energy stored in terms of $\vec{E}$ and $\vec{D}$ **(05 Marks)**

d. Derive Boundary conditions for conductor and Dielectric interface. **(06 Marks)**

3 a. Expand ∇^2 operation in different co-ordinate system. **(03 Marks)**

b. Verify that the potential field given below satisfies the Laplace equation

$V = 2x^2 - 3y^2 + z^2$

$V = [Ar^4 + Br^{-4}]$ Sin 4P **(08 Marks)**

c. Solve the Laplace equation for the potential field and find the capacitance in homogeneous region between two concentric conducting spheres with radii a and b such that b > a if V = 0 at r = b, V = Vo at r = a. **(09 Marks)**

4 a. Derive expression for $\vec{H}$ due to straight conductor of finite length. **(08 Marks)**

b. State and explain the following

i) Ampere circuit law

ii) Stokes theorem. **(08 Marks)**

c. Given the vector magnetic potential

$\vec{A} = x^2\,\vec{ax} + 2yz\,\vec{ay} + (-x^2)\,\vec{az}$

Find magnetic flux density. **(04 Marks)**

PART – B

5 a. Derive expression for force on a differential current element **(06 Marks)**

b. A current element $I_1\,\Delta L_1 = 10^{-5}\,\vec{az}$ A.m is located at $P_1(1, 0, 0)$ while second element $I_2\,\Delta L_2 = 10^{-5}\,(0.6\,\vec{ax}\ \ 2\,\vec{ay} + 3\,\vec{az})$ A.m is at P_2 (-1, 0,0) both in free space find the vector force exerted on $I_2\,\Delta\,L_2$ by $I_1\,\Delta L_1$ **(08 Marks)**

c. Derive an equation of inductance of Toroid. **(06 Marks)**

6 a. Derive Maxwell's equations for time varying fields. **(08 Marks)**
b. $\vec{E} = Em\ \sin\ (wt - Bz)\ \overrightarrow{ay}$ in free space find $\vec{D}, \vec{B}, \vec{H}$ **(05 Marks)**
c. Define displacement current density. **(02 Marks)**
d. Derive continuity equation from Maxwell's equation. **(05 Marks)**

7 a. Derive General wave equation **(08 Marks)**
b. The uniform plane wave travelling in free space is given by
$Ey = 10.4\ e^{j(2\pi\times10^9 t - \beta x)}\ \mu v/m$
Find:
i) Direction of wave propagation.
ii) Phase velocity
iii) Phase constant
iv) Equation for magnetic field **(08 Marks)**
c. For $E = E_m e^{-\alpha z} \cos (wt - \beta z)\ \overrightarrow{ax}$ find average power density. Assume free space. **(04 Marks)**

8 a. Derive expression for transmission co-efficient and Reflection co-efficient for uniform waves at normal incidence. **(08 Marks)**
b. For $n_1 = 100\Omega$, $n_2 = 100\Omega$ and $Ex_1 = 100v/m$ calculate amplitude of incident, reflected and transmitted waves. Also show that average power is conserved. **(10 Marks)**
c. Define SWR. **(02 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Advanced Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

1 a. Express the following in the form a + ib,
$\frac{3}{1+i}-\frac{1}{2-i}+\frac{1}{1-i}$ and also find the conjugate. **(06 Marks)**

b. Show that $(a+ib)^n+(a-ib)^n=2(a^2+b^2)^{n/2}\cos(n\tan^{-1}(b/a))$. **(07 Marks)**

c. Find the fourth roots of $1-i\sqrt{3}$ and represent them on an argand plane. **(07 Marks)**

2 a. Find the n^{th} derivative of cos 2x cos 3x. **(06 Marks)**

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

c. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$. **(07 Marks)**

3 a. Find the angle between the radius vector and the tangent to the curve $r=a(1-\cos\theta)$ at the point $\theta=\frac{\pi}{3}$. **(06 Marks)**

b. Find the pedal equation to the curve $r=a(1+\cos\theta)$. **(07 Marks)**

c. Obtain the Maclaurin's series expansion of the function $e^x\sin x$. **(07 Marks)**

4 a. If $u=e^{x^3+y^3}$, then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=3u\log u$. **(06 Marks)**

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

c. If $u=x^2+y^2+z^2$, $v=xy+yz+zx$, $w=x+y+z$, find $J\left(\frac{u,v,w}{x,y,z}\right)$. **(07 Marks)**

5 a. Obtain the reduction formula for $I_n=\int_0^{\pi/2}\cos^n x\,dx$ where n is a positive integer. **(06 Marks)**

b. Evaluate : $\int_0^{2a}\int_0^{\sqrt{2ax-x^2}} xy\,dy\,dx$. **(07 Marks)**

c. Evaluate : $\int_0^1\int_0^1\int_0^1 (x+y+z)\,dx\,dy\,dz$. **(07 Marks)**

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, will be treated as malpractice.

6 a. Prove that $\beta(m,n)=\dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

b. Evaluate: $\int_0^4 x^{3/2}(4-x)^{5/2}\,dx$. **(07 Marks)**

c. Evaluate: $\int_0^\infty x^6 e^{-3x}\,dx$. **(07 Marks)**

7 a. Solve: $\dfrac{dy}{dx}+x\sin 2y=x^3\cos^2 y$. **(06 Marks)**

b. Solve: $(e^y+y\cos xy)dx+(xe^y+x\cos xy)dy=0$. **(07 Marks)**

c. Solve: $x^2ydx-(x^3+y^3)dy=0$. **(07 Marks)**

8 a. Solve: $\dfrac{d^3y}{dx^3}-6\dfrac{d^2y}{dx^2}+11\dfrac{dy}{dx}-6y=0$. **(06 Marks)**

b. Solve : $(D^2-4)y=e^x+\sin 2x$. **(07 Marks)**

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

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