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10MAT31

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
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. Expand $f(x)=\sqrt{1-\cos x}$, $0 < x < 2\pi$ in a Fourier series. Hence evaluate $\frac{1}{1.3}+\frac{1}{3.5}+\frac{1}{5.7}+\ldots$ **(07 Marks)**

b. Find the half-range sine series of $f(x) = e^x$ in (0, 1). **(06 Marks)**

c. In a machine the displacement y of a given point is given for a certain angle x as follows:

x	0	30	60	90	120	150	180	210	240	270	300	330
y	7.9	8	7.2	5.6	3.6	1.7	0.5	0.2	0.9	2.5	4.7	6.8

Find the constant term and the first two harmonics in Fourier series expansion of y. **(07 Marks)**

2 a. Find Fourier transform of $e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{\cos xt}{1+t^2}dt$. **(07 Marks)**

b. Find Fourier sine transform of $f(x)=\begin{cases} x, & 0<x\le 1 \\ 2-x, & 1\le x<2 \\ 0, & x>2 \end{cases}$. **(06 Marks)**

c. Solve the integral equation $\int_0^\infty f(x)\cos\lambda x\,dx = e^{-\lambda}$. **(07 Marks)**

3 a. Find various possible solution of one-dimensional heat equation by separable variable method. **(10 Marks)**

b. A rectangular plate with insulated surface is 10cm wide and so long compared to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature of the short edge y = 0 is given by

$u = 20x, \ 0 \le x \le 5$

$= 20\,(10 - x), \ 5 \le x \le 10$

and the two long edges x = 0, x = 10 as well as the other short edge are kept at 0°C. Find the temperature u(x, y). **(10 Marks)**

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

x	1	5	7	9	12
y	10	15	12	15	21

b. Use graphical method to solve the following LPP:

Minimize $Z = 20x_1 + 30x_2$

Subject to $x_1 + 3x_2 \ge 5$;

$2x_1 + 2x_2 \ge 20$;

$3x_1 + 2x_2 \ge 24$;

$x_1, x_2 \ge 0$. **(06 Marks)**

c. Solve the following LPP by using simplex method:

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1 \geq 0,\ x_2 \geq 0.$ **(07 Marks)**

PART – B

5 a. Use the Gauss-Seidal iterative method to solve the system of linear equations. $27x + 6y - z = 85$; $6x + 15y + 2z = 72$; $x + y + 54z = 110$. Carry out 3 iterations by taking the initial approximation to the solution as (2, 3, 2). Consider four decimal places at each stage for each variable. **(07 Marks)**

b. Using the Newton-Raphson method, find the real root of the equation $x\sin x + \cos x = 0$ near to $x = \pi$, carryout four iterations (x in radians). **(06 Marks)**

c. Find the largest eigen value and the corresponding eigen vector of the matrix $A = \begin{pmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{pmatrix}$ by power method. Take $\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ as the initial vector. Perform 5 iterations. **(07 Marks)**

6 a. Find f(0.1) by using Newton's forward interpolation formula and f(4.99) by using Newton's backward interpolation formula from the data: **(07 Marks)**

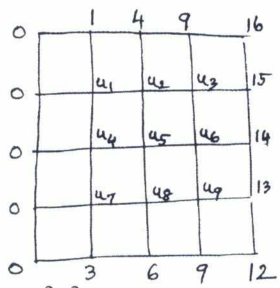
x	0	1	2	3	4	5
f(x)	-8	0	20	58	120	212

b. Find the interpolating polynomial f(x) by using Newton's divided difference interpolation formula from the data: **(06 Marks)**

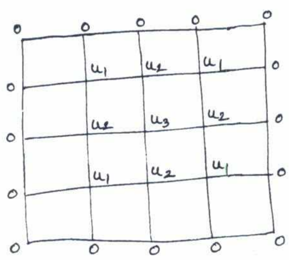
x	0	1	2	3	4	5
f(x)	3	2	7	24	59	118

c. Evaluate $\int_0^{1.2} e^x\,dx$ using Weddle's rule. Taking six equal sub intervals, compare the result with exact value. **(07 Marks)**

7 a. Solve $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ in the following square mesh. Carry out two iterations. **(07 Marks)**



b. Solve the Poisson's equation $\nabla^2 u = 8x^2y^2$ for the square mesh given below with u = 0 on the boundary and mesh length, h = 1. **(06 Marks)**



c. Evaluate the pivotal values of $\frac{\partial^2 u}{\partial t^2} = 16\frac{\partial^2 u}{\partial x^2}$ taking h = 1 upto t = 1.25. The boundary conditions are u(0, t) = 0, u(5, t) = 0, $\frac{\partial u}{\partial t}(x,0) = 0$, $u(x, 0) = x^2(5 - x)$. **(07 Marks)**

8 a. Find the Z-transforms of i) $\left(\frac{1}{2}\right)^n + \left(\frac{1}{3}\right)^n$ ii) $3^n \cos\frac{\pi n}{4}$. **(07 Marks)**

b. State and prove initial value theorem in Z-transforms. **(06 Marks)**

c. Solve the difference equation $u_{n+2} - 2u_{n+1} + u_n = 2^n$; $u_0 = 2, u_1 = 1$. **(07 Marks)**

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Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
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:
i) Practical diode model.
ii) Ideal diode model.
iii) Piecewise linear model. **(08 Marks)**

b. Consider a half wave and full wave rectifier with capacitor input filter. Derive an expression for ripple factor. **(08 Marks)**

c. Explain the operation of negative clamper circuit. **(04 Marks)**

2 a. Consider a fixed bias circuit of a transistor. Obtain expressions for stability factor S_{ICO}, S_{VBE} and S_β. Draw the circuit diagram. **(10 Marks)**

b. Design a voltage divider bias circuit for the given conditions: $I_C = 1$ mA, $S_{ICO} = 20$, $\beta = 100$, $V_E = 1$ V, $V_{CE} = 6$ V and $V_{CC} = 12$ V. Draw the circuit diagram. **(10 Marks)**

3 a. For the common collector circuit shown in Fig. Q3 (a), the transistor h-parameters are $h_{fc} = -101$, $h_{rc} = 1$, $h_{oc} = 25$ µA/V, $h_{ic} = 1.2$ K. Determine R_i, A_i, A_v, A_{vs} and R_o for the circuit. **(10 Marks)**

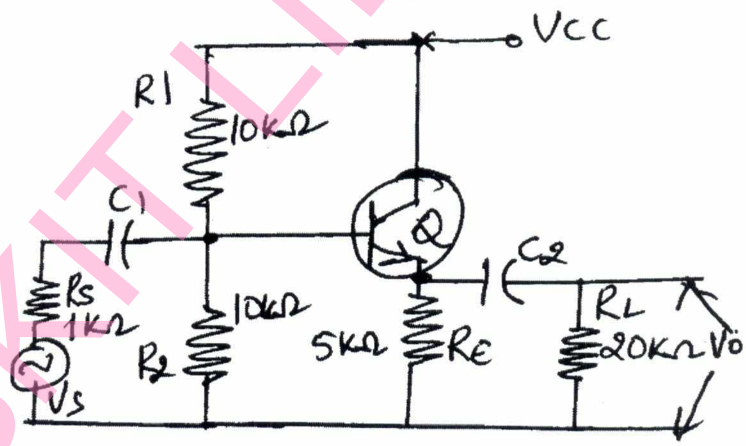

Fig. Q3 (a)

b. State and prove Miller's theorem. **(05 Marks)**

c. Obtain r-parameter model for CB mode. **(05 Marks)**

4 a. Explain the low frequency response of single stage RC coupled amplifier. **(10 Marks)**

b. An amplifier consists of 3 identical stages in cascade, the bandwidth of overall amplifier extends from 20 Hz to 20 kHz. Determine the bandwidth of individual stage. **(05 Marks)**

c. For an amplifier, the midband gain is 100 and lower cut-off frequency is 1 kHz. Calculate the gain of the amplifier at frequency of 20 Hz. **(05 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.

PART – B

5 a. Consider Darlington emitter follower circuit. Obtain expressions for R_{i2}, R_{i1}, A_{i2}, A_{i1}. Compare R_i and A_i of each and overall stage if $R_E = 3.3\ k\Omega$, $h_{ie} = 1.1\ k\Omega$, $h_{re} = 2.5\times10^{-4}$, $h_{fe}=50$ and $h_{oe} = 25\ \mu A/V$. **(10 Marks)**

b. For a voltage series feedback amplifier topology, obtain expression for A_V and R_{if}. Also explain the principle of voltage amplifier used in feedback amplifiers. **(10 Marks)**

6 a. Derive an expression for second harmonic distortion in power amplifiers, using 3-point method. **(10 Marks)**

b. A complementary symmetry push pull amplifier is operated with $V_{CC} = \pm10V$, $R_L = 5\Omega$. Determine maximum output power, power rating of transistors and DC input power. **(10 Marks)**

7 a. Explain the concept of positive feedback used in oscillators. **(05 Marks)**

b. Obtain an expression for frequency of oscillation in Colpitt's oscillator. **(10 Marks)**

c. In a RC phase shift oscillator using transistor, $f_0 = 10$ kHz, $R_1 = 25\ k\Omega$, $R_2 = 57\ k\Omega$, $R_C = 20\ k\Omega$, $R = 7.1\ k\Omega$ and $h_{ie} = 1.8\ k\Omega$. Calculate the capacitor C and h_{fe}. Draw the circuit diagram. **(05 Marks)**

8 a. Consider a n-channel JFET using voltage divider bias. Explain its DC analysis. Also derive an expression for transconductance g_m. **(10 Marks)**

b. Design a fixed bias circuit of Fig. Q8 (b) to have ac gain of -15. Calculate the value of R_D to get this gain, if $V_{DD} = 40$ V, $R_G = 10\ M\Omega$, $I_{DSS} = 10$ mA, $V_P = -4$ V, $Y_{OS} = 20\ \mu s$, $C_1 = 0.1\ \mu F$. **(10 Marks)**

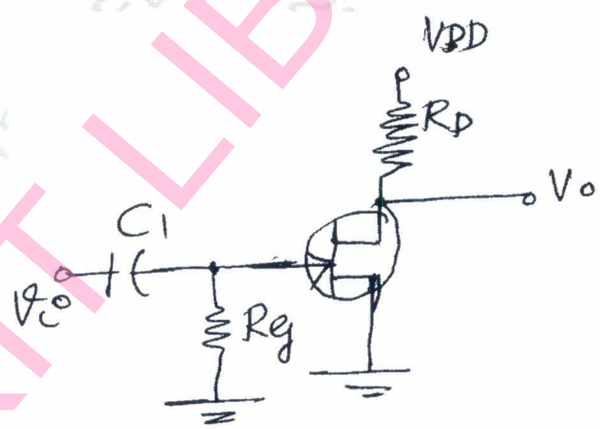

Fig. Q8 (b)

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10ES33

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
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 combinational circuit which takes two, 2 – bit binary numbers as its input and generates an output equal to 1, when the sum of the two numbers is odd. **(06 Marks)**

b. Convert the given Boolean function into :

i) $R = f(a,b,c) = (\bar{a} + b)(b + \bar{c})$ minterm canonical form

ii) $P = f(x,y,z) = x + \overline{xz}(y + \bar{z})$ maxterm canonical form. **(06 Marks)**

c. Distinguish prime implicant and essential prime implicant. Determine PI and EPI for the given function N = f(a, b, c, d) = π(0, 1, 4, 5, 8, 9, 11) + d(2, 10) . Simplify the given function and implement using logic gates. **(08 Marks)**

2 a. Simplify the given Boolean function using Quine – Mccluskey method :
Y = f(a, b, c, d) = Σ(0, 1, 2, 6, 7, 9, 10, 12) + d(3, 5). Verify the result using k-map. **(10 Marks)**

b. Find the minimal sum and minimal product for the given Boolean function, using MEV technique : Solve by using 3-variable map and 2 – variable map y = f(a, b, c, d) = Σ(2, 3, 4, 5, 13, 15) + d(8, 9, 10, 11). **(10 Marks)**

3 a. Distinguish between a decoder and an encoder. Implement full adder using IC 74138. **(08 Marks)**

b. Implement 3 – bit binary to gray code conversion by using IC 74139. **(06 Marks)**

c. Design a priority encoder for a system with a 3 inputs, the middle bit with highest priority encoding to 10, the MSB with next priority encoding to 11, while the LSB with least priority encoding to 01. **(06 Marks)**

4 a. Realize the following Boolean function : P = f(w, x, y, z) = Σ(0, 1, 5, 6, 7, 10, 15) using :
i) 16 to 1 MUX ii) 8 : 1 MUX iii) 4 : 1 MUX. **(10 Marks)**

b. With a neat logic diagram, explain carry look ahead adder. **(10 Marks)**

PART – B

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

b. With a neat logic diagram, explain the working of positive edge triggered D flip-flop. **(10 Marks)**

6 a. Obtain the characteristic equation for D and T flip-flop. **(06 Marks)**

b. With a neat logic diagram, explain the operation of 4-bit SISO unidirectional shift register. **(06 Marks)**

c. Explain the working of four-bit binary ripple up counter, configured using positive edge triggered flip-flop. Also draw the timing diagram. **(08 Marks)**

7 a. Design synchronous mod-6 counter using D flip-flop to generate the sequence 0, 2, 3, 6, 5, 1, 0 …….. . **(10 Marks)**

b. Compare Mealy and Moore sequential circuit models. **(04 Marks)**

c. Analyze the sequential circuit shown in Fig. Q7(c). **(06 Marks)**

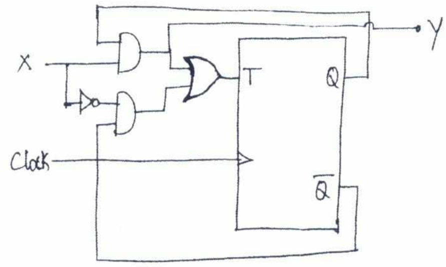

Fig. Q7(c)

Write input and output equations, transition table, state table and state diagram.

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

b. Compare synchronous and asynchronous counter. **(04 Marks)**

c. A sequential circuit has one input and one output. The state diagram is as shown in the Fig. Q8(c). Design the sequential circuit with J-K flip-flop. **(10 Marks)**

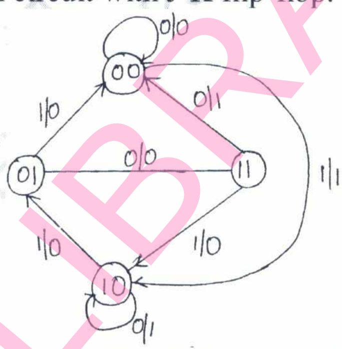

Fig. Q8(c)

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10ES34

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Network Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. For the network shown in Fig. Q1(a). Find the potential difference between M and N using source transformation. **(04 Marks)**

b. Using star/ delta transformation, determine the resistance between M and N of network shown in Fig. Q1(b). **(04 Marks)**

c. For the network shown in Fig. Q1(c), find power supplied by 10V source using mesh current analysis. **(06 Marks)**

d. For the network shown in Fig. Q1(d), find the magnitude of source voltage such that current in 4 ohm is zero. Use node voltage analysis. **(06 Marks)**

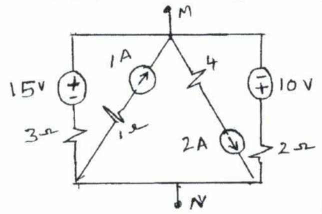

Fig. Q1(a)

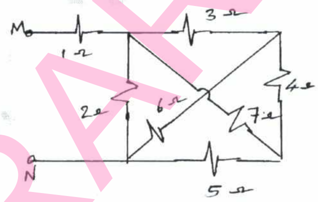

Fig. Q1(b)

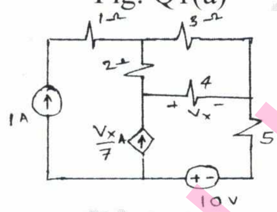

Fig. Q1(c)

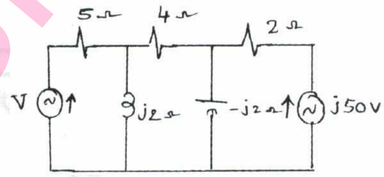

Fig. Q1(d)

2 a. Explain element – node incidence matrix with example. List the properties of the element node incidence matrix. **(06 Marks)**

b. For the network shown in Fig. Q2(b). Determine branch voltages. On voltage basis. **(08 Marks)**

c. Write KVL equation for the network shown. Draw the dual of this a write KCL equation and show that these two networks are dual. (Fig. Q2(c)). **(06 Marks)**

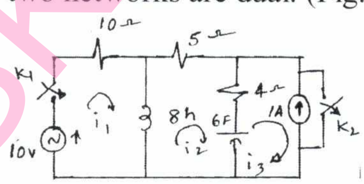

Fig. Q2(c)

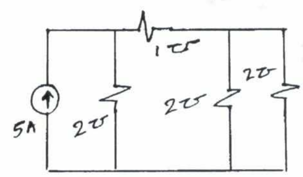

Fig. Q2(b)

3 a. Use superposition theorem to find I_x of the network shown in Fig. Q3(a). **(08 Marks)**

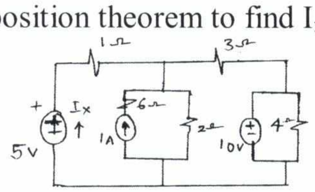

Fig. Q3(a)

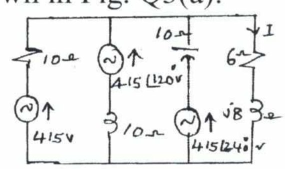

Fig. Q3(b)

b. For the circuit shown in Fig. Q3(b), find current 'I' using Millimun's theorem. **(06 Marks)**

c. State and prove reciprocity theorem. **(06 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. State and explain maximum power transfer theorem when load impedance consisting of variable resistance and variable reactance. **(08 Marks)**

b. For the network shown in Fig. Q4(b). Draw the Thevenin's equivalent circuit. **(05 Marks)**

c. Using Norton's theorem, find the current 'I' of the network shown in Fig. Q4(C). **(07 Marks)**

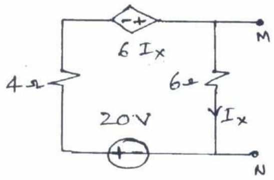

Fig. Q4(b)

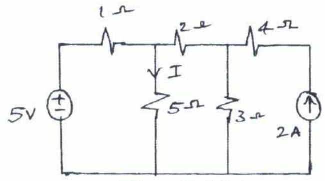

Fig. Q4(c)

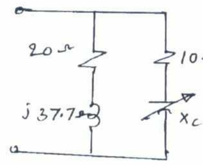

Fig. Q5(c)

PART – B

5 a. What is resonance? Derive an expression for cut-off frequencies. **(08 Marks)**

b. Calculate half power frequencies of series resonant circuit where the resonance frequency is 150 KHz and band width is 75 KHz. **(04 Marks)**

c. For the circuit shown in Fig. Q5(c), find two values of capacitor for the resonance. Derive the formula used Take f = 50 Hz. **(08 Marks)**

6 a. What is initial and final condition? Explain the behaviour of R, L and C for the initial condition. **(06 Marks)**

b. For the circuit shown in Fig. Q6(b), switch k is opened at t = 0, after reaching the steady state condition. Determine voltage drop across switch and its first and second derivative at $t = 0^+$. **(08 Marks)**

c. In the circuit shown, in Fig. Q6(c), switch k is closed at t = 0. Find $v_a(0-)$ and $V_a(0+)$. **(06 Marks)**

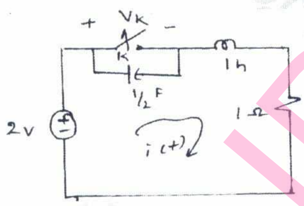

Fig. Q6(b)

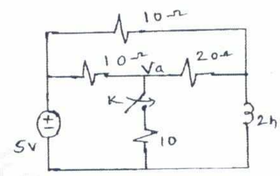

Fig. Q6(c)

7 a. For the circuit shown in Fig. Q7(a), switch 'k' is closed at t = 0. The initial current through inductance is 1A and initial voltage across the capacitor is 1V. Obtain expression for current i(+) for t ≥ 0. **(08 Marks)**

b. For the circuit shown in Fig. Q7(b) switch is closed at t = 0. The initial current through an inductance is 2A. Obtain expression for $V_0(+)$ for t ≥ 0. **(06 Marks)**

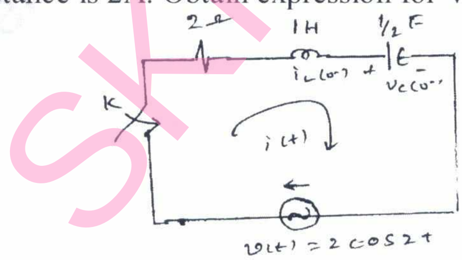

Fig. Q7(a)

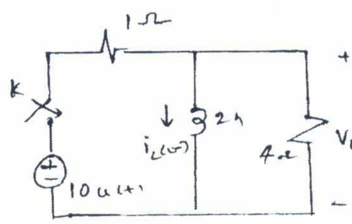

Fig. Q7(b)

c. Synthesis the waveform shown in Fig. Q7(c) and find the Laplace transform of the periodic waveform. **(06 Marks)**

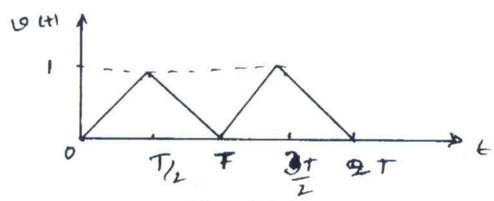

Fig. Q7(c)

8 a. Obtain transmission parameters in terms of hybrid parameters. **(06 Marks)**

b. For the network shown in Fig. Q8(b). Find the z – parameters. **(08 Marks)**

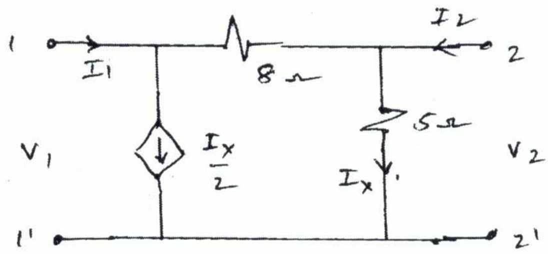

Fig. Q8(b)

c. Following short circuit currents and voltages are obtained experimentally for a two port network :

i) With output short circuited : $I_1 = 5$ mA ; $I_2 = -0.3$ mA and $V_1 = 25$ V

ii) With input short circuited : $I_1 = -5$ mA ; $I_2 = +10$mA and $V_2 = 30$ V.

Determine Y – parameters. **(06 Marks)**

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10IT35

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following terms as applied to an electronic instruments:
i) Accuracy ii) Significant figure iii) Resolution. **(06 Marks)**

b. Draw a basic DC voltmeter circuit, derive expression for multifier resistance and calculate its value for a voltage range of (0 – 10)V if a full scale deflection current of 40 μA and internal resistance of the meter is 500 Ω. **(08 Marks)**

c. Explain the working of a true RMS voltmeter with the help of a suitable block diagram. **(06 Marks)**

2 a. Explain the working of linear ramp type DVM. **(08 Marks)**

b. Explain the working of a digital frequency meter with the help of a block diagram. **(08 Marks)**

c. What is 3-½ digit DVM? Define its sensitivity. **(04 Marks)**

3 a. Draw the basic block diagram of an oscilloscope. Explain the function of each block. **(08 Marks)**

b. Describe the following modes of operation in a dual trace oscilloscope:
i) Alternate mode ii) Chop mode. **(08 Marks)**

c. What is the role of Time base generator? **(04 Marks)**

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

b. Explain Mesh storage and phosphor storage techniques used in storage oscilloscope. **(06 Marks)**

c. What is sampling oscilloscope? What are its advantages and disadvantages? **(04 Marks)**

PART – B

5 a. What is Barkhausen criteria? Explain with block diagram AF sine-square wave generator. **(10 Marks)**

b. Explain general pulse characteristics. **(04 Marks)**

c. Explain working sweep frequency generator. **(06 Marks)**

6 a. The Wheatstone bridge is shown in Fig.Q6(a) below. The galvanometer has a current sensitivity of 12mm/μA. The internal resistance of galvanometer is 200 Ω. Calculate the deflection of galvanometer caused due to 5 Ω unbalance in the arm AD. **(06 Marks)**

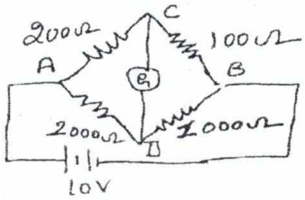

Fig.Q6(a)

b. Explain and derive expression for Maxwell's bridge. If bridge constants are $C_1 = 0.5\ \mu F$, $R_1 = 1200\ \Omega$, $R_2 = 700\ \Omega$, $R_3 = 300\ \Omega$. Find the resistance and inductance of coil. (08 Marks)

c. Explain Wagner's Earth connection. (06 Marks)

7 a. Explain Resistive position Transducer and a resistance position transducer uses a shaft with a stroke of 3 inch. The total resistance of the potentiometer is 5 kΩ. Calculate the output voltage when wiper is 0.9 inch from extreme end if applied voltage is 5V. (08 Marks)

b. Explain construction, principle and operation of LVDT. Show characteristics curves. (06 Marks)

c. What is thermistor? Explain different forms of thermistors. (06 Marks)

8 a. Explain in brief effects of photo conductive and photovoltaic transducer. (06 Marks)

b. What is LED and LCD? Compare LED and LCD in brief. (06 Marks)

c. Write short notes on :

i) RF Power Measurement using Bolometer

ii) Lab View (08 Marks)

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10ES36

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State vector form of Coloumb's law of force between two point charges and indicate the units of the quantities in the equation. **(06 Marks)**

b. State and prove Gauss law for point charge. **(06 Marks)**

c. Two point charges, Q_1 and Q_2 are located at $(1, 2, 0)_m$ and $(2, 0, 0)_m$ respectively. Find the relation between the charges Q_1 and Q_2 such that the total force on a unit positive charge at (–1, 1, 0) have i) no x – component ii) no y – component. **(08 Marks)**

2 a. Define potential difference and absolute potential. **(04 Marks)**

b. Establish the relation $E = -\nabla V$. **(06 Marks)**

c. Electrical potential at an arbitrary point in free – space is given as :
$V = (x+1)^2 + (y+2)^2 + (z+3)^2$ volts. At P(2, 1, 0) find

i) V ii) $\vec{E}$ iii) $|\vec{E}|$ iv) $\vec{D}$ v) $|\vec{D}|$ vi) P_V. **(10 Marks)**

3 a. Derive the expression for Poisson's and Laplace's equation. **(04 Marks)**

b. Write the expression for Laplace's equation in cylindrical and spherical coordinates. **(04 Marks)**

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

d. Given the potential field $V = 3x^2yz + ky^3z$ volts :
i) Find k if potential field satisfies Laplace's equation
ii) Find $\vec{E}$ at (1, 2, 3). **(06 Marks)**

4 a. Starting form Biot-Savort's law, derive the expression for the magnetic field intensity at a point due to finite length current carrying conductor. **(08 Marks)**

b. Verify Stoke's theorem for the field $\vec{H} = 2r\cos\theta a\,\hat{r} + ra\,\hat{\theta}$ for the path shown $r = 0$ to 1 ; $\theta = 0$ to $90°$. **(08 Marks)**

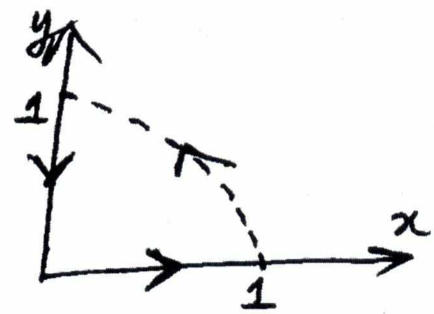

Fig. Q4(b)

c. Explain scalar and vector magnetic potential. **(04 Marks)**

PART – B

5 a. Derive expression for magnetic force on :
   i) Moving point charge
   ii) Differential current element. **(10 Marks)**

b. A current element $I_1 dl_1 = 10^{-4}\ \hat{a}_z$ (Am) is located at $P_1(2, 0, 0)$ and another current element $I_2 dl_2 = 10^{-6}\ [\hat{a}x - 2\hat{a}y + 3\hat{a}z]$ (Am) is located at $P_2(-2, 0, 0)$. Both are in free space :
   i) Find force exerted on $I_2 dl_2$ by $I_1 dl_1$
   ii) Find force exerted on $I_1 dl_1$ by $I_2 dl_2$. **(10 Marks)**

6 a. List Maxwell's equations in point form and integral form. **(08 Marks)**

b. A homogeneous material has $\varepsilon = 2 \times 10^{-6}$ F/m and $\mu = 1.25 \times 10^{-5}$ H/m and $\sigma = 0$. Electric field intensity $\vec{E} = 400\cos(10^9 t - kz)a\hat{x}\ V/m$. If all the fields vary sinusoidally, find $\vec{D}$, $\vec{B}$, $\vec{H}$ and k using Maxwell's equations. **(12 Marks)**

7 a. Starting form Maxwell's equations derive wave equation in E and H for a uniform plane wave travelling in free space. **(10 Marks)**

b. State and explain Poynting theorem. **(10 Marks)**

8 a. Write short notes on :
   i) SWR and reflection coefficient
   ii) Skin depth. **(10 Marks)**

b. A 10 GHz plane wave in free space has electric field intensity 15 V/m. Find :
   i) Velocity of propagation
   ii) Wavelength
   iii) Characteristic impedance of the medium
   iv) Amplitude of magnetic field intensity
   v) Propagation constant β. **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Express : $\frac{(3+i)(1-3i)}{2+i}$ in the form x + iy. **(05 Marks)**

b. Find the modulus and amplitude of the complex number $1 + \cos\alpha + i\sin\alpha$. **(05 Marks)**

c. If $(3x - 2iy)(2 + i)^2 = 10(1 + i)$, then find the values of x and y. **(05 Marks)**

d. Prove that $(\cos\theta_1 + i\sin\theta_1)(\cos\theta_2 + i\sin\theta_2) = \cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)$. **(05 Marks)**

2 a. Find the n^{th} derivative of $e^{ax}\cos(bx + c)$. **(06 Marks)**

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

c. Compute the n^{th} derivatives of $\sin x \sin 2x \sin 3x$. **(07 Marks)**

3 a. With usual notations prove that $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$. **(06 Marks)**

b. Prove that the curves cuts $r^n = a^n\cos n\theta$, and $r^n = b^n\sin n\theta$ orthogonally. **(07 Marks)**

c. Expand $\log(1 + \sin x)$ in powers of x by Maclaurin's theorem up to the terms containing x^3. **(07 Marks)**

4 a. If $u = x^2y + y^2z + z^2x$, prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = (x + y + z)^2$. **(06 Marks)**

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

c. If $u = e^x\cos y$, $v = e^x\sin y$, find $J = \frac{\partial(u,v)}{\partial(x,y)}, J' = \frac{\partial(x,y)}{\partial(u,v)}$ and verify $JJ' = 1$. **(07 Marks)**

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

b. Evaluate : $\int_0^1\int_x^{\sqrt{x}}(x^2 + y^2)dxdy$. **(07 Marks)**

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

6 a. Define Gamma function. Prove that $\Gamma(n + 1) = n\Gamma(n)$. **(06 Marks)**

b. With usual notation prove that : $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

c. Prove that $\beta\left(m,\frac{1}{2}\right) = 2^{2m-1}\beta(m,m)$. **(07 Marks)**

7 a. Solve : $\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$. **(05 Marks)**

b. Solve : $\frac{dy}{dx} = 1 + \frac{y}{x} + \left(\frac{y}{x}\right)^2$. **(05 Marks)**

c. Solve : $\frac{dy}{dx} + y \cot x = \sin x$. **(05 Marks)**

d. Solve : $(x^2 + y)dx + (y^3 + x)dy = 0$. **(05 Marks)**

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

b. Solve : $y'' - 6y' + 9y = e^x + 3^x$. **(07 Marks)**

c. Solve : $\frac{d^2y}{dx^2} + 4y = x^2 + \sin 3x$. **(07 Marks)**

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