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10MAT31

Third Semester B.E. Degree Examination, June/July 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. Find the Fourier series for the function $f(x) = x(2\pi - x)$ in $0 \le x \le 2\pi$. Hence deduce that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + - - - - -$. **(07 Marks)**

b. Find the half-range cosine series for the function $f(x) = (x-1)^2$ in $0 < x < 1$. **(06 Marks)**

c. Obtain the constant term and the co-efficient of the 1st sine and cosine terms in the Fourier series of y as given in the following table. **(07 Marks)**

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

2 a. Solve the integral equation :

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

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

b. Find the Fourier transform of $f(x) = e^{-|x|}$. **(06 Marks)**

c. Find the infinite Fourier cosine transform of e^{-x^2}. **(07 Marks)**

3 a. Solve two dimensional Laplace equation $u_{xx} + u_{yy} = 0$ by the method of separation of variables. **(07 Marks)**

b. 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 $\frac{\partial u}{\partial t}(x,0) = 0$. **(06 Marks)**

c. Solve the boundary value problem $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$, $0 < x < \ell$ subject to the conditions $\frac{\partial u}{\partial x}(0,t) = 0$; $\frac{\partial u}{\partial x}(\ell,t) = 0$, $u(x, 0) = x$. **(07 Marks)**

4 a. Find the equation of the best fit straight line for the following data and hence estimate the value of the dependent variable corresponding to the value of the independent variable x with 30. **(07 Marks)**

x	5	10	15	20	25
y	16	19	23	26	30

b. Solve by graphical method :
Max Z = x + 1.5 y
Subject to the constraints $x + 2y \le 160$
$3x + 2y \le 240$
$x \ge 0$; $y \ge 0$. **(06 Marks)**

c. Solve by simplex method :
max z = 3x + 5y
subject to $3x + 2y \le 18$
$x \le 4$
$y \le 6$
$x, y \ge 0$. **(07 Marks)**

PART – B

5 a. Using the method of false position, find a real root of the equation $x \log_{10} x - 1.2 = 0$, correct to 4 decimal places. **(07 Marks)**

b. By relaxation method, solve :
$10x + 2y + z = 9$; $x + 10y - z = -22$; $-2x + 3y + 10z = 22$. **(06 Marks)**

c. Find the largest Eigen value and the corresponding Eigen vector for the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ using Rayleigh's power method, taking $x_0 = [1\ 1\ 1]^T$. Perform 5 iterations. **(07 Marks)**

6 a. Find the cubic polynomial by using Newton's forward interpolation formula which takes the following values.

x	0	1	2	3
y	1	2	1	10

Hence evaluate f(4). **(07 Marks)**

b. Using Lagrange's formula, find the interpolating polynomial that approximate the function described by the following table.

x	0	1	2	5
f(x)	2	3	12	147

Hence find f(3). **(06 Marks)**

c. Evaluate $\int_4^{5.2} \log_e x \, dx$ using Weddler's rule by taking 7 ordinates. **(07 Marks)**

7 a. Solve $u_{xx} + u_{yy} = 0$ in the following square Mesh. Carry out two iterations. **(07 Marks)**

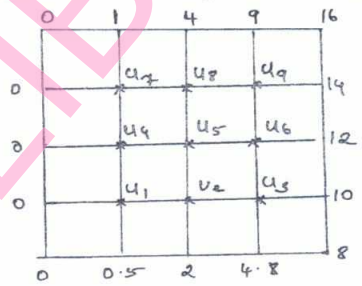

Fig. Q7(a)

b. The transverse displacement of a point at a distance x from one end to any point 't' of a vibrating string satisfies the equation : $\frac{\partial^2 u}{\partial t^2} = 25\frac{\partial^2 u}{\partial x^2}$ with boundary condition u(0, t) = u(5, t) = 0 and initial condition $u(x, 0) = \begin{cases} 20x & \text{for } 0 \le x \le 1 \\ 5(5-x) & \text{for } 1 \le x \le 5 \end{cases}$ and $u_t(x, 0) = 0$ solve by taking h = 1, k = 0.2 upto t = 1. **(06 Marks)**

c. Find the solution of the equation $u_{xx} = 2u_t$ when u(0, t) = 0 and u(4, t) = 0 and u(x, 0) = x(4 – x) taking h = 1. Find values upto t = 5. **(07 Marks)**

8 a. Find the Z – transformation of the following : i) $3n - 4\sin\frac{\pi}{4} + 5a^2$ ii) $\frac{a^n e^{-a}}{n!}$. **(07 Marks)**

b. Find the inverse Z – transformation of $\frac{4z^2 - 2z}{z^3 + 5z^2 + 8z - 4}$. **(06 Marks)**

c. Solve the difference equation : $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$; given $y_0 = y_1 = 0$ using Z – transformation. **(07 Marks)**

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10ES32

Third Semester B.E. Degree Examination, June/July 2016

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 Reverse recovery time of a semiconductor diode. **(06 Marks)**

b. The Fig. Q1 (b) shows two way clipper. Determine its output wave form. Assume diode drop of 0.7V. **(07 Marks)**

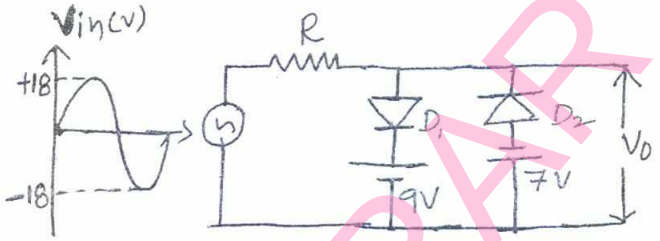


Fig. Q1(b)

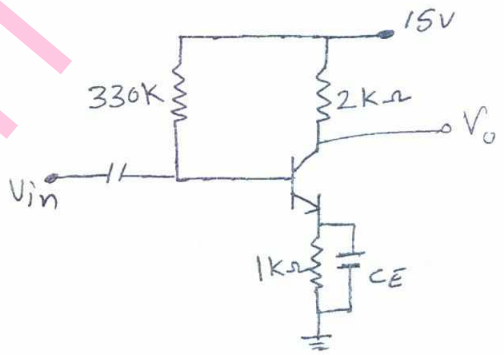
c. What is clamper circuit? Explain the operation of Positive and Negative clamper circuits and draw the wave form. [Assume Ideal Diode]. **(07 Marks)**

2 a. What is transistor biasing? Discuss the causes of bias instability in a transistor. **(06 Marks)**

b. Derive the expression for I_B, V_{CE} and $S(I_{CO})$ for voltage divider bias using exact analysis. **(07 Marks)**

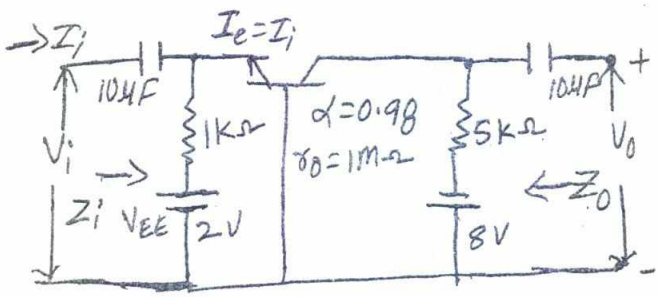
c. For the circuit shown in Fig. Q2(c). Find I_B, I_C, V_{CE}, V_C and V_E. Assume $\beta = 100$, VBE = 0.7. **(07 Marks)**

Fig. Q2(c)



3 a. For common base configuration shown in Fig Q3(a). Find r_e, z_i, z_o and A_v. **(06 Marks)**

Fig. Q3(a)



b. Derive an expression for z_i, z_o, A_V and A_i of a CE fixed bias configuration using r_e model. **(07 Marks)**

c. Using h-parameter model for a transistor in C.E configuration. Derive expressions for A_I, z_i and A_v. **(07 Marks)**

4 a. An amplifier consists of 3 identical stages in cascade; the bandwidth of overall amplifier extends from 20Hz to 20KHz. Calculate the band width of Individual stage. **(06 Marks)**

b. Describe miller effect and derive an equation for miller input and output capacitance. **(07 Marks)**

c. Draw and explain frequency response of an amplifier and briefly discuss the effect of various capacitors on frequency response. **(07 Marks)**

PART – B

5 a. Explain the need of cascade amplifier and list the advantage of this circuit. **(06 Marks)**

b. With block diagram, explain the concept of feedback. List the advantages of negative feedback. **(07 Marks)**

c. Derive the expression for input resistance (R_{if}) for voltage series feedback amplifier. **(07 Marks)**

6 a. Draw input and output wave forms of Class – A, Class – B and Class – C power amplifiers based on the location of Q - point, and briefly discuss. **(06 Marks)**

b. Draw the circuit diagram of series fed directly coupled Class – A amplifier. Give the expression for dc power input and a.c power output and show that efficiency is 25%. **(07 Marks)**

c. What is Harmonic distortion? Calculate the harmonic distortion components for an output signal having fundamental amplitude of 2.5V second harmonic amplitude of 0.25V, third harmonic amplitude of 0.1 V and fourth harmonic amplitude of 0.05V. Also calculate the total harmonic distortion. **(07 Marks)**

7 a. With neat circuit diagram explain the operation of BJT Hartley oscillator. **(06 Marks)**

b. i) The frequency sensitive arms of the wien bridge oscillator uses $C_1 = C_2 = 0.001\mu F$ and $R_1 = 10k\Omega$ while R_2 is kept variable. The frequency is to be varied from 10KHz to 50KHz by varying R_2. Find the minimum and maximum values of R_2.

ii) Design the value of an inductor to be used in Colpitts oscillator to generate a frequency of 10MHz. The circuit is used a value of $C_1 = 100pF$ and $C_2 = 50pF$. **(07 Marks)**

c. With neat circuit explain the working of series resonant crystal oscillator. A crystal has L = 0.1H, C = 0.01pF find the series resonating frequency. **(07 Marks)**

8 a. Define transconductance g_m and derive expression for gm. **(06 Marks)**

b. With equivalent model of JFET common drain configuration. Obtain the expression for z_i, z_o and A_v. **(07 Marks)**

c. For common gate amplifier as shown in Fig Q8.(c), gm = 2.8ms, r_d = 50kΩ Calculate z_i, z_o and A_V. **(07 Marks)**

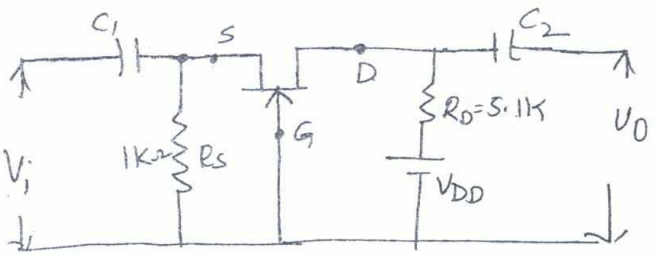


Fig. Q8(c)

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10ES33

Third Semester B.E. Degree Examination, June/July 2016
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following canonical form :

i) $F(x,y,z) = x + \bar{x}\,y + \bar{x}\,\bar{z}$

ii) $F(x,y,z) = (x+z)(\bar{x}+y)(y+z)$ **(10 Marks)**

b. Find the minimal POS expression of incompletely specified Boolean function using K–map,

$f(a, b, c, d) = \pi M(1, 2, 3, 4, 9, 10) + \pi d(0, 14, 15)$. **(05 Marks)**

c. Find all the minimal SOP expression of
$f(a, b, c, d) = \Sigma(6, 7, 9, 10, 13) + \Sigma d(1, 4, 5, 11, 15)$ using k – map. **(05 Marks)**

2 a. Find all the prime implicants of the function :
$f(a, b, c, d) = \Sigma(7, 9, 12, 13, 14, 15) + \Sigma d(4, 11)$ using Quine – MaClusky's algorithm. **(10 Marks)**

b. For a given incomplete Boolean function, find a minimal sum and minimal product expression using MEV technique taking least significant bit as map entered variable.
$f(a, b, c, d) = \Sigma(1, 5, 6, 7, 9, 11, 12, 13) + \Sigma d(0, 3, 4)$. **(10 Marks)**

3 a. Implement the function using active low output dual 2 : 4 line decoder IC74139

i) $f_1(A, B, C) = \Sigma m(0, 1, 2, 5)$

ii) $f_2(A, B, C) = \pi M(1, 3, 4, 7)$. **(10 Marks)**

b. Design priority encoder with three inputs, with middle bit at highest priority encoding to 10, most significant bit at next priority encoding to 11 and least significant at least priority encoding 01. **(10 Marks)**

4 a. Define multiplexer and demulitplexer and draw block diagram. **(04 Marks)**

b. Design 4 : 1 multiplexer, draw the circuit using gates. **(06 Marks)**

c. Explain how will you implement the following function using implementation table,
$F(A, B, C, D) = \Sigma m(0, 1, 3, 4, 7, 10, 12, 14)$ with A, B, C as select lines. **(10 Marks)**

PART – B

5 a. Design full adder and draw the circuit using two input NAND gates. **(07 Marks)**

b. Design and draw the circuit of look ahead carry generator using gates. Draw the block diagram of 4–bit parallel adder using look ahead carry generator. **(10 Marks)**

c. Design single bit magnitude comparator and draw the circuit. **(03 Marks)**

6 a. Obtain the following for SR flip–flop :
   i) Characteristic equation
   ii) Excitation table
   iii) State diagram. **(06 Marks)**

b. With the help of a schematic diagram, explain how a serial shift register can be transformed into a i) ring counter ii) Johnson counter. **(04 Marks)**

c. Design mod6 synchronous counter using D–flip–flops. **(10 Marks)**

7 a. A sequential network has one input and one output the state diagram is shown in Fig. Q7(a). Design the sequential circuit using T flip-flops. **(10 Marks)**

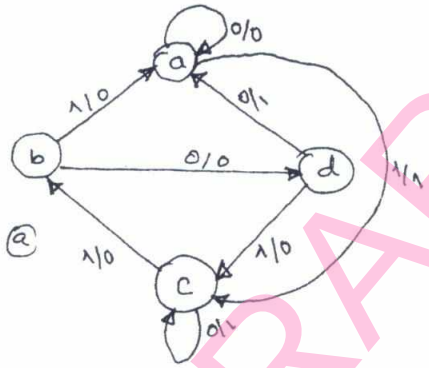

Fig. Q7(a)

b. Derive the transition equations, transition table, state table and state diagram for the following. **(10 Marks)**

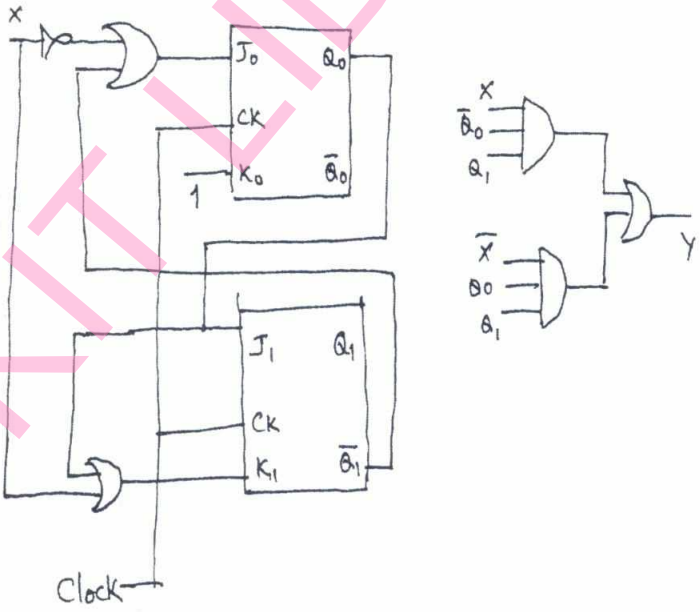

Fig. Q7(b)

8 Write notes on :
   a. Mealy and Moore model
   b. State machine notation. **(20 Marks)**

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10ES34

Third Semester B.E. Degree Examination, June/July 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. Using source transformation find current through R_L in the circuit shown in Fig. Q1(a). **(06 Marks)**

b. Using mesh current method find current through 10Ω resistor in the circuit shown in Fig. Q1(b). **(07 Marks)**

c. Find all the nodal voltages in the circuit shown in Fig Q1 (c). **(07 Marks)**

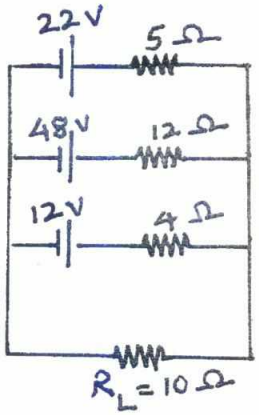


Fig. Q1(a)

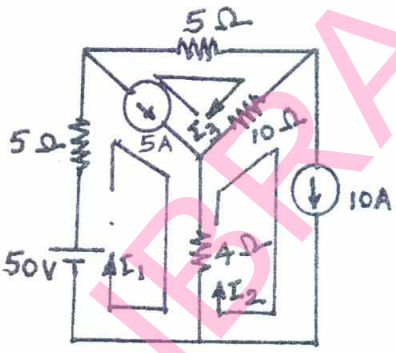


Fig. Q1(b)

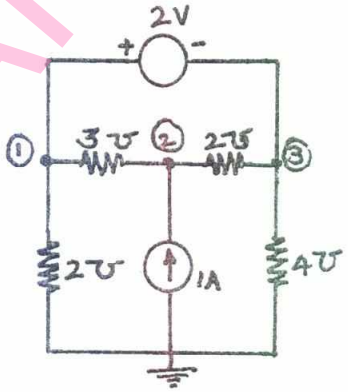


Fig. Q1(c)

2 a. With neat illustrations, distinguish between
i) Oriented and Non-oriented graphs
ii) Connected and un-connected graphs
iii) Tree and co-tree. **(06 Marks)**

b. For the network shown in Fig. Q2(b), draw the oriented graph. By selecting braches 4, 5 and 6 as twigs, write down tie-set schedule. Using this tie-set schedule, find all the branch currents and branch voltages. **(14 Marks)**

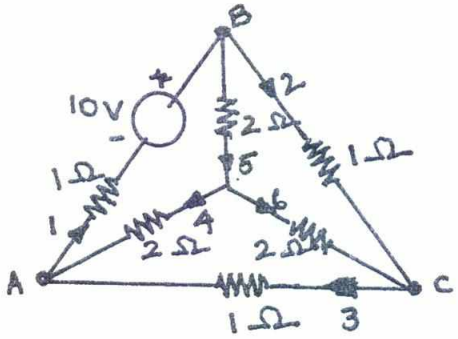


Fig. Q2(b)

3 a. State and illustrate superposition theorem. **(05 Marks)**

b. Using superposition theorem, find value of i in the circuit shown in Fig.Q3(b). **(08 Marks)**

c. Find the value of V_x in the circuit shown in Fig. Q3(c). Verify it using Reciprocity theorem. **(07Marks)**

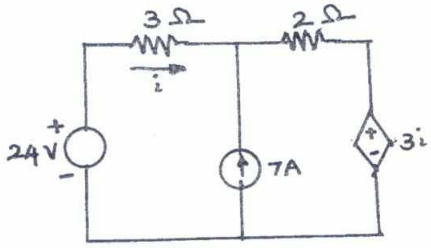


Fig.Q3(b)

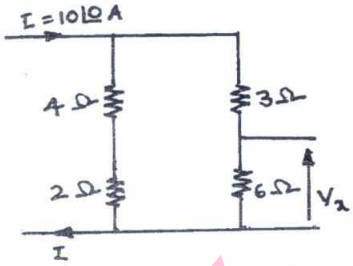
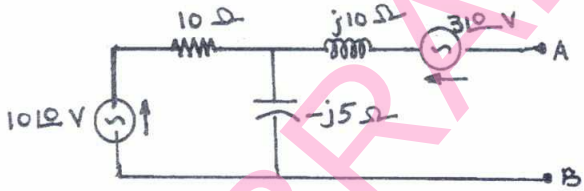


Fig. Q3(c)

4 a. Show that the power delivered to load, when the load impedance consists of variable resistance and variable reactance is maximum when the load impedance(Z_L) is equal to complex conjugate of source impedance (Z_g). **(10 Marks)**

b. Obtain Thevenin's equivalent network of the circuit shown in Fig. Q4(b) and thereby find current through 5Ω resistor connected between terminals A and B. **(10 Marks)**

Fig. Q4(b)



PART – B

5 a. With respect to series resonant circuit, define resonant frequency (f_r) and half power frequencies (f_1 and f_2). Also show that the resonant frequency is equal to the geometric mean of half power frequencies. **(10 Marks)**

b. A series circuit is energized by a constant voltage and constant frequency supply. Resonance takes place due to variation of inductance and the supply frequency is 300Hz. The capacitance in the circuit is 10μF. Determine the value of resistance in the circuit if the quality factor is 5. Also find the value of the inductance at half power frequencies. **(10 Marks)**

6 a. In the circuit shown in Fig. Q6(a), the switch K is changed from position A to B t = 0. After having reached steady state in position A. Find i, $\frac{di}{di}, \frac{d^2i}{dt^2}$ and $\frac{d^3i}{dt^3}$ at $t = 0^+$. **(10 Marks)**

b. In the circuit shown in Fig. Q6(b) switch K is opened at t = 0. Find i, $\frac{di}{dt}$, V_3 and $\frac{dV_3}{dt}$ at $t = 0^+$. **(10 Marks)**

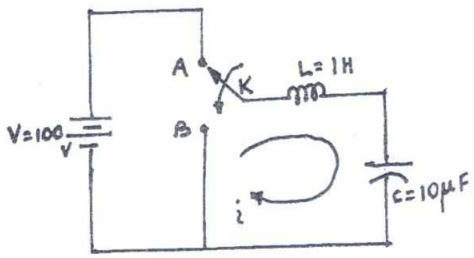


Fig. Q6(a)

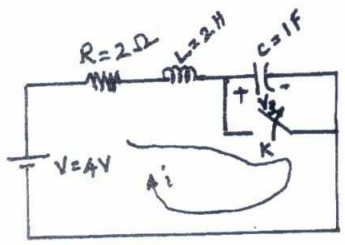


Fig. Q6(b)

7 a. Using convolution theorem find the inverse Laplace transform of following functions.

i) $F(s) = \frac{1}{(s-a)^2}$ and ii) $F(s) = \frac{1}{s(s+1)}$ **(10 Marks)**

b. Obtain the Laplace transform of the triangular waveform shown in Fig Q7(b). **(10 Marks)**

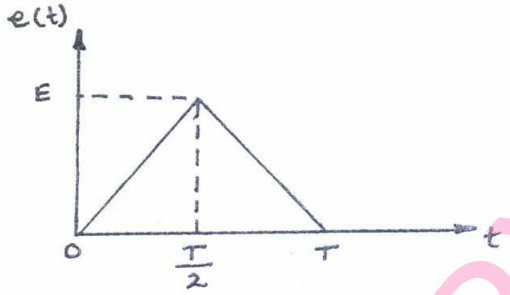


Fig. Q7(b)

8 a. Define h and T parameters of a two – port network. Also, derive the expressions for h parameters in terms of T parameters. **(10 Marks)**

b. Find Y and Z parameters for the network shown in Fig. Q8(b). **(10 Marks)**

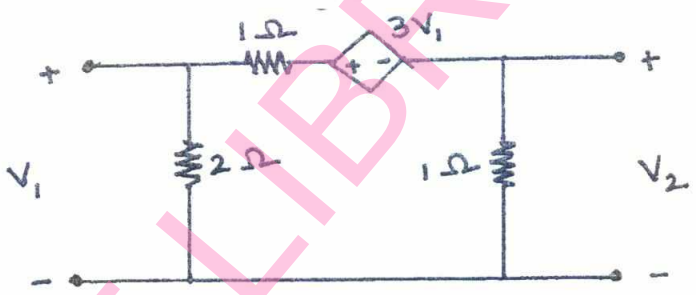


Fig. Q8(b)

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10IT35

Third Semester B.E. Degree Examination, June/July 2016

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. Explain the following with examples:
i) Accuracy ii) Precision iii) Resolution **(06 Marks)**

b. A component manufacturer constructs certain resistances to be anywhere between 1.14 KΩ and 1.26 KΩ and classifies them to be 1.2 KΩ resistors. What tolerance should be stated? If the resistance values are specified at 25°C and resistor have a temperature coefficient of +500 ppm/°C. Calculate the maximum resistance that one of these components might have at 75°C. **(07 Marks)**

c. Determine the reading obtained with a dc voltmeter in the circuit Fig.Q1(c). When the switch is set to position 'A', then set the switch to position 'B' and determine the reading obtained with a HWR and FWR ac voltmeter.

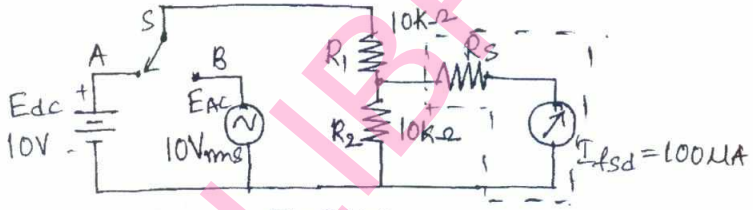

Fig.Q1(c) **(07 Marks)**

2 a. With a neat block diagram, explain the principle and working of successive approximation DVM. **(07 Marks)**

b. Explain with the help of block diagram the operation of a DFM. **(07 Marks)**

c. With a block schematic, explain the principle and working of dual slope integrating type DVM. **(06 Marks)**

3 a. Explain C.R.T. features briefly. **(08 Marks)**

b. List the advantages of using negative supply in C.R.O. **(04 Marks)**

c. Describe with a diagram and waveform the operation of a dual trace CRO in ALTERNATE and CHOP Mode. **(08 Marks)**

4 a. With a block diagram, explain construction and working of digital storage oscilloscope. **(10 Marks)**

b. Draw basic block diagram of a delayed-time-base (DTB) system. Sketch waveform and explain the operation. **(10 Marks)**

PART – B

5 a. With a block diagram, explain modern laboratory signal generator. **(10 Marks)**

b. Draw the block diagram of a frequency synthesizer using PLL. Explain its operation. **(10 Marks)**

6 a. An unbalanced Wheatstone bridge given in Fig.Q6(a). Calculate the current through Galvanometer.

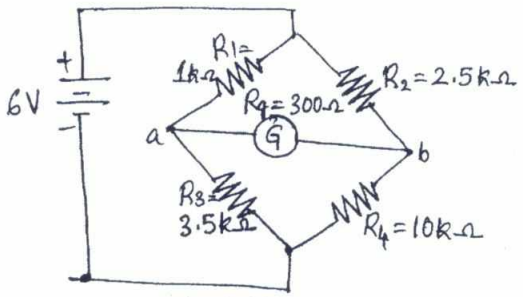

Fig.Q6(a) **(07 Marks)**

b. State and derive the two balance conditions for a Wein bridge. **(07 Marks)**

c. The arms of an ac Maxwell's bridge are arranged as follows:
AB and BC are non-reactive resistors of 100 Ω each, DA a standard variable reactor L_1 of resistance 32.7 Ω and CD consists of a standard variable resistor R in series with a coil of unknown impedance Z, balance was found with L_1 = 50 mH and Z_1 = 1.36 R. Find R and L of coil. **(06 Marks)**

7 a. With a neat diagram, explain differential output transducer. **(07 Marks)**

b. State the advantages and limitations of thermistor. **(07 Marks)**

c. A displacement transducer with a shaft stroke of 3.0 in. is applied to circuit of Fig.Q7(c). The total resistance of potentiometer is 5 KΩ. The applied voltage V_t is 5V when the wiper is 0.9 in. from B, what is the value of output voltage?

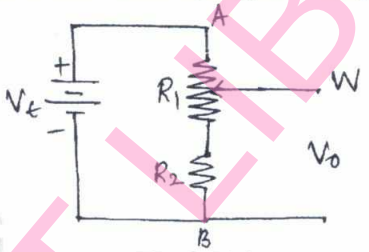

Fig.Q7(c) **(06 Marks)**

8 a. With a diagram, explain self balancing bolometer bridge. **(05 Marks)**

b. Explain piezo electrical transducer with a circuit diagram. **(05 Marks)**

c. State important features of LCD displays. **(05 Marks)**

d. Write short notes on LabVIEW. **(05 Marks)**

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10ES36

Third Semester B.E. Degree Examination, June/July 2016
Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Three point charges $Q_1 = -1$ μc, $Q_2 = -2$ μc and $Q_3 = -3$ μc are placed at the corners of an equilateral triangle of side 1 m. Find the magnitude of the electric field intensity at the point bisecting the joining Q_1 and Q_2. **(07 Marks)**

b. Derive an expression for the electric field intensity due to infinite line charge. **(08 Marks)**

c. Let $\vec{D} = (2y^2z - 8xy)\hat{a}_x + (4xyz - 4x^2)\hat{a}_y + (2xy^2 - 4z)\hat{a}_z$. Determine the total charge within a volume of 10^{-14} m^3 located at P(1, –2, 3). **(05 Marks)**

2 a. Infinite number of charges each of Qnc are placed along x axis at x = 1, 2, 4, 8,……∞. Find the electric potential and electric field intensity at a point x = 0 due to the all charges. **(06 Marks)**

b. Find the work done in assembling four equal point charges of 1 μc each on x and y axis at ±3m and ±4m respectively. **(06 Marks)**

c. Derive the expression for a capacitance of a parallel plate capacitor. **(08 Marks)**

3 a. Explain Poisson's and Laplace's equations. **(06 Marks)**

b. Find $\vec{E}$ at P(3, 1, 2) for the field of two co-axial conducting cylinders V = 50 V at ρ = 2 m and V = 20 V at ρ = 3m. **(08 Marks)**

c. Using Poisson's equation obtain the expression for the potential in a p-n junction. **(06 Marks)**

4 a. An infinite filament on the z-axis carries 20π mA in the $\hat{a}_z$ direction. Three uniform cylindrical sheets are also present, 400 mA/m at r = 1 cm, - 250 mA/m at r = 2 cm, 400 mA/m at r = 3m. Calculate H_ϕ at r = 0.5, 1.5 and 2.5 cm in cylindrical co-ordinates. **(10 Marks)**

b. If the vector magnetic potential at a point in a space is given as $\vec{A} = 100\rho^{1.5}\hat{a}_z$ wb/m, find the following : (i) $\vec{H}$ (ii) J and show that $\oint \vec{H}.d\vec{c} = I$ for the circular path with ρ = 1. **(10 Marks)**

PART – B

5 a. A conductor 4 m long lies along the y-axis with a current of 10.0 A in the $\hat{a}_y$ direction. Find the force on the conductor if the field in the region is $\vec{B} = 0.005\ \hat{a}_z$ Tesla. **(04 Marks)**

b. Discuss the boundary between two magnetic materials of different permeabilities. **(08 Marks)**

c. A solenoid with air core has 2000 turns and a length of 5000 mm. Core radius is 40 mm. Find its inductance. **(08 Marks)**

6 a. Find the frequency at which conduction current density and displacement current density are equal in a medium with $\sigma = 2\times10^{-4}$ ℧/m and $\in_r = 81$. **(04 Marks)**

b. Given $\vec{H} = H_m e^{j(\omega t + \beta z)} \hat{a}_x$ A/m in free space. Find $\vec{E}$. **(06 Marks)**

c. Explain the concept of retarded potential. Derive the expressions for the same. **(10 Marks)**

7 a. The magnetic field intensity of uniform plane wave in air is 20 A/m in $\hat{a}_y$ direction. The wave is propagating in the $\hat{a}_z$ direction at an angular frequency of 2×10^9 rad/sec. Find:

(i) Phase shift constant (ii) Wavelength

(iii) Frequency (iv) Amplitude of electric field intensity. **(08 Marks)**

b. Explain electromagnetic wave in Good conductor. **(08 Marks)**

c. The depth of penetration in a certain conducting medium is 0.1 m and the frequency of the electromagnetic wave is 1.0 MHz. Find the conductivity of the conducting medium. **(04 Marks)**

8 a. Derive the expression for transmission co-efficient and reflection co-efficient. **(08 Marks)**

b. Define standing wave ratio. What value of S results is reflection coefficient equals ± ½? **(06 Marks)**

c. Given $\gamma = 0.5$, $\eta_1 = 100\ (\Omega)$, $\eta_2 = 300\ (\Omega)$. $E'_{x_i} = 100$ (V/m). Calculate values for the incident, reflected and transmitted waves. Also show that the average power is conserved. **(06 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June/July 2016
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 a + ib. **(06 Marks)**

b. Find the modulus and amplitude of $1 + \cos\theta + i\sin\theta$. **(07 Marks)**

c. Find the cube root of $1 - i$. **(07 Marks)**

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

b. Find the n^{th} derivative of $\frac{6x}{(x-2)(x+2)(x-1)}$. **(07 Marks)**

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

3 a. Find the angle of intersection of the curves $r^2\sin 2\theta = a^2$, $r^2\cos 2\theta = b^2$. **(06 Marks)**

b. Find the nodal equation of the curve $r(1 - \cos\theta) = 2a$. **(07 Marks)**

c. Expand log (secx) upto the term containing x^4 using Maclaurin's series. **(07 Marks)**

4 a. If $u = x^3 - 3xy^2 + x + e^x\cos y + 1$, show that $u_{xx} + u_{yy} = 0$. **(06 Marks)**

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

c. Find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$, where $u = x + y + z$, $v = y + z$, $w = z$. **(07 Marks)**

5 a. Obtain reduction formula for $\int\cos^n x\ dx$, where n is positive integer. **(06 Marks)**

b. Evaluate $\int_0^2 \frac{x^4}{\sqrt{4-x^2}}dx$. **(07 Marks)**

c. Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2 + y^2 + z^2)\,dz\,dy\,dx$. **(07 Marks)**

6 a. Prove that: i) $\Gamma(n+1) = n\,\Gamma(n)$ and ii) $\Gamma(n+1) = n!$ for a positive integer n. **(06 Marks)**

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

c. Show that $\int_0^{\pi/2} \dfrac{d\theta}{\sqrt{\sin\theta}} \cdot \int_0^{\pi/2} \sqrt{\sin\theta}\, d\theta = \pi$. **(07 Marks)**

7 a. Solve $\dfrac{dy}{dx} = (9x + y + 1)^2$. **(06 Marks)**

b. Solve $ye^{xy}\,dx + (xe^{xy} + 2y)\,dy = 0$. **(07 Marks)**

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

8 a. Solve $\dfrac{d^2y}{dx^2} - 6\dfrac{dy}{dx} + 9y = 5e^{-2x}$. **(06 Marks)**

b. Solve $(D^2 - 4D + 13)y = \cos 2x$. **(07 Marks)**

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

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