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10MAT31

Third Semester B.E. Degree Examination, June/July 2015

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. Expand f(x) = x sin x as a Fourier series in the interval $(-\pi, \pi)$, Hence deduce the following:

i) $\frac{\pi}{2} = 1 + \frac{2}{1.3} - \frac{2}{3.5} + \frac{2}{5.7}$

ii) $\frac{\pi - 2}{4} = \frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - + \ \ldots$ **(07 Marks)**

b. Find the half–range Fourier cosine series for the function

$$f(x) = \begin{cases} kx, & 0 \le x \le \ell/2 \\ k(\ell - x), & \ell/2 < x \le \ell \end{cases}$$

Where k is a non-integer positive constant. **(06 Marks)**

c. Find the constant term and the first two harmonics in the Fourier series for f(x) given by the following table.

x :	0	π/3	2π/3	π	4π/3	5π/3	2π
F(x) :	1.0	1.4	1.9	1.7	1.5	1.2	1.0

(07 Marks)

2 a. Find the Fourier transform of the function $f(x) = xe^{-a|x|}$ **(07 Marks)**

b. Find the Fourier sine transforms of the

Functions $f(x) = \begin{cases} \sin x, & 0 < x < a \\ 0, & x \ge a \end{cases}$ **(06 Marks)**

c. Find the inverse Fourier sine Transform of

$F_x(\alpha) = \frac{1}{\alpha} e^{-a\alpha}$ $a > 0$. **(07 Marks)**

3 a. Find various possible solution of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$ by separable variable method. **(07 Marks)**

b. Obtain solution of heat equation $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial t^2}$ subject to condition u(0,t) =0, u (ℓ ,t) = 0, u (x, 0) = f(x). **(06 Marks)**

c. Solve Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to condition u (0, y) = u(ℓ ,y) =0, u (x, 0) = 0, u (x, a) = $\sin\left(\frac{\pi x}{\ell}\right)$. **(07 Marks)**

4 a. The pressure P and volume V of a gas are related by the equation $PV^r = K$, where r and K are constants. Fit this equation to the following set of observations (in appropriate units)

P :	0.5	1.0	1.5	2.0	2.5	3.0
V:	1.62	1.00	0.75	0.62	0.52	0.46

(07 Marks)

b. Solve the following LPP by using the Graphical method :

Maximize : $Z = 3x_1 + 4x_2$

Under the constraints $4x_1 + 2x_2 \le 80$

$2x_1 + 5x_2 \le 180$

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

c. Solve the following using simplex method

Maximize : $Z = 2x + 4y$, subject to the

Constraint : $3x + y \le 2z$, $2x + 3y \le 24$, $x \ge 0$, $y \ge 0$. **(07 Marks)**

PART – B

5 a. Using the Regular – Falsi method, find a real root (correct to three decimal places) of the equation $\cos x = 3x - 1$ that lies between 0.5 and 1 (Here, x is in radians). **(07 Marks)**

b. By relaxation method

Solve : $-x + 6y + 27z = 85$, $54x + y + z = 110$, $2x + 15y + 6z = 72$. **(06 Marks)**

c. Using the power method, find the largest eigen value and corresponding eigen vectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

taking $[1, 1, 1]^T$ as the initial eigen vectors. Perform 5 iterations. **(07 Marks)**

6 a. From the data given in the following Table ; find the number of students who obtained

(i) Less than 45 marks ii) between 40 and 45 marks.

Marks	30 – 40	40 – 50	50 – 60	60 – 70	70 - 80
No. of Students	31	42	51	35	31

(07 Marks)

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

x	0	1	2	3	4
f(x)	3	6	11	18	27

Hence find f (0.5) and f (3.1). **(06 Marks)**

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by using Simpson's $\left(\frac{3}{8}\right)^{th}$ Rule, dividing the interval into 3 equal parts.

Hence find an approximate value of $\log\sqrt{2}$. **(07 Marks)**

7 a. Solve the one – dimensional wave equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$

Subject to the boundary conditions u (0, t) = 0, u (1, t) = 0, $t \ge 0$ and the initial conditions $u(x, 0) = \sin \pi x$, $\frac{\partial u}{\partial t}(x, 0) = 0$, $0 < x < 1$. **(07 Marks)**

b. Consider the heat equation $2\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ under the following conditions:

i) $u(0, t) = u(4, t) = 0,\ t \geq 0$

ii) $u(x, 0) = x(4 - x),\ 0 < x < 4.$

Employ the Bendre – Schmidt method with $h = 1$ to find the solution of the equation for $0 < t \leq 1$. **(06 Marks)**

c. Solve the two – dimensional Laplace equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial y^2} = 0$ at the interior pivotal points of the square region shown in the following figure. The values of u at the pivotal points on the boundary are also shown in the figure. **(07 Marks)**

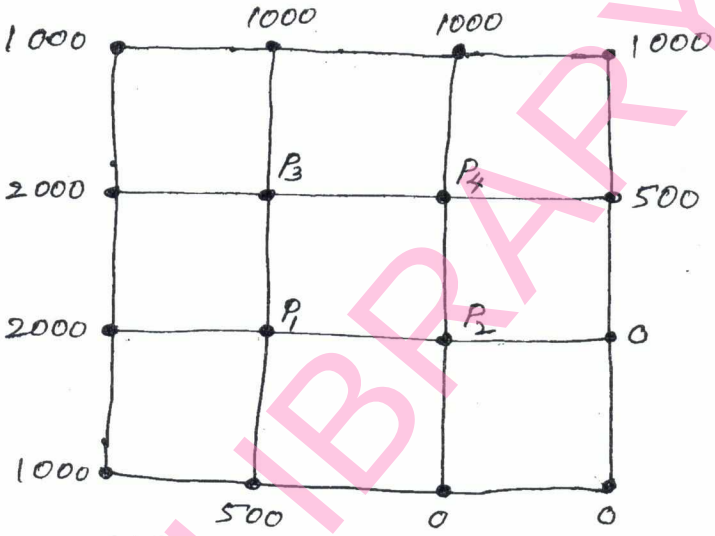

Fig. Q7 (c)

8 a. State and prove the recurrence relation of Z – Transformation hence find $Z_T(n^p)$ and $Z_T\left[\cosh\left(\frac{n\pi}{2} + \theta\right)\right]$. **(07 Marks)**

b. Find $Z_T^{-1}\left[\frac{z^3 - 20z}{(z-2)^3(z-4)}\right]$ **(06 Marks)**

c. Solve the difference equation

$y_{n+2} - 2y_{n+1} - 3y_n = 3^n + 2n$

Given $y_0 = y_1 = 0$. **(07 Marks)**

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10ES32

Third Semester B.E. Degree Examination, June/July 2015
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain the various resistance levels of the semiconductor diode. **(06 Marks)**

b. Explain the working of a full wave centre tapped rectifier. Also determine ripple factor, efficiency and voltage regulation. **(10 Marks)**

c. Design a suitable circuit represented by the box shown below, which has the input and output waveforms as indicated. **(04 Marks)**

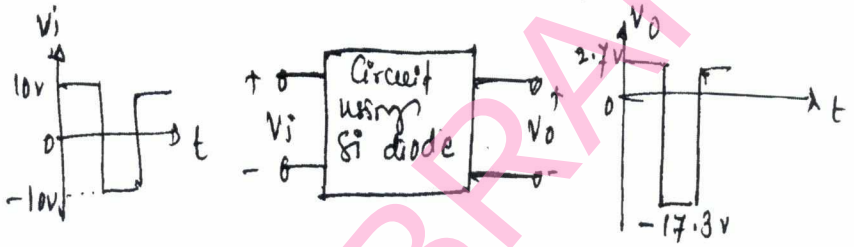

Fig. Q1(c)

2 a. Name different biasing methods of transistor. With circuit diagram analyze the fixed bias circuit, with effect of variation in I_B, R_c and V_{CC} on Q. point of the load line. **(10 Marks)**

b. Explain the circuit of a transistor switch being used as an inverter. **(04 Marks)**

c. In a voltage divider bias circuit of BJT. V_{CC} = 20 V, R_C = 10 kΩ, RE = 1.5 kΩ, R_1 = 40 kΩ, R_2 = 4 kΩ. Assume silicon transistor with β = 150. Find I_C, V_{CE} and $I_{C(sat)}$ using exact analysis. **(06 Marks)**

3 a. Define h – parameters and hence derive h – parameters model of CE – BIT. **(06 Marks)**

b. Explain with a neat circuit diagram of emitter follower configuration. Justify how voltage gain is nearly equal to one. **(06 Marks)**

c. For the circuit shown below determine V_{CC}, if A_V = –160 and r_0 = 100 kΩ. Take β = 100. **(08 Marks)**

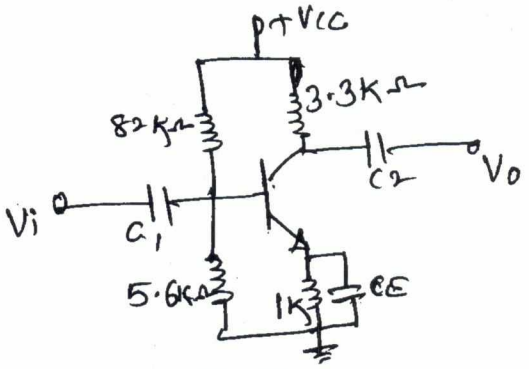

Fig. Q3(c)

4 a. Draw the single stage RC coupled BJT amplifier and discuss the effect of (low frequency response) : i) Input capacitance C_S ii) output capacitance C_C and iii) Emitter by pass capacitance C_e on frequency response. **(05 Marks)**

b. Prove that miller effect of input capacitance $C_{Mi} = (1 - A_v) Cf$ and output capacitance $C_{M0} = \left(1 - \frac{1}{A_v}\right) C_f$. **(10 Marks)**

c. It is desired that the voltage gain of an RC – coupled amplifier at 60 Hz should not decrease by more than 10% from its mid bond value. Calculate :
i) the lower 3 dB frequency
ii) the required C if R = 2000 Ω. **(05 Marks)**

PART – B

5 a. Derive expressions for Z_i and A_i for a Darlington emitter follower circuit. **(10 Marks)**

b. Mention the types of feedback connections. Draw their block diagrams indicating input and output signal. **(06 Marks)**

c. List the general characteristics of a negative feedback amplifier and write its advantages. **(04 Marks)**

6 a. With a neat circuit diagram, explain the operation of a transformer coupled class A power amplifier. **(07 Marks)**

b. Explain the operation of a class B push-pull amplifier and derive its conversion efficiency. **(08 Marks)**

c. The following distortion reading are available for a power amplifier :
$D_2 = 0.2$, $D_3 = 0.02$, $D_4 = 0.06$, with $I_1 = 3.3$ A and $R_C = 4$ Ω. Calculate :
i) the THD ii) the fundamental power component iii) the total power. **(05 Marks)**

7 a. Explain the working of Wien bridge oscillator. **(07 Marks)**

b. With a neat circuit diagram, explain the operation of BJT Colpitts oscillator. **(06 Marks)**

c. A crystal has the following parameter L = 0.334 H, $C_M = 1$ pF, C = 0.065 and R = 5.5 kΩ. Calculate the series resonant frequency, parallel resonant frequency and find Q of the crystal. **(07 Marks)**

8 a. Draw the JFET common drain configuration (source – follower) circuit. Derive Zi, Z_0 and A_v using small signal model. Write its characteristics. **(10 Marks)**

b. Compare JFET and MOSFET. **(03 Marks)**

c. For the JFET common drain configuration shown below. Given $I_{dss} = 10$ mA, $V_P = -5$V, $r_d = 40$ kΩ, $V_{GSQ} = -2.85$ V i) Calculate Z_i and Z_0 ii) Calculate A_v iii) find V_0 if $V_i = 20$ mV (p – p). **(07 Marks)**

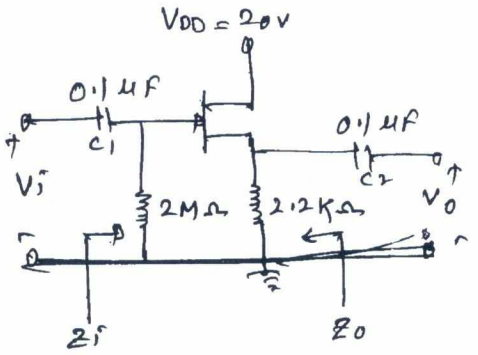

Fig. Q8(c)

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10ES33

Third Semester B.E. Degree Examination, June/July 2015
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. Express the following Boolean function in canonical min term form :
$F(A,B,C) = \overline{A}\,\overline{B} + C$. **(04 Marks)**

b. Express the following Boolean function in canonical max term form :
$F(A,B,C,D) = \overline{A}B + C\overline{D}$. **(08 Marks)**

c. Simplify the following Boolean function using four variable 'k' map. Realize the simplified expression using NAND gates.
$F(A, B, C, D) = \sum m(1, 5, 6, 7, 11, 12, 13, 15)$. **(08 Marks)**

2 a. Simplify the following Boolean function using Quine – Moclusky's minimization technique.
$F(A, B, C, D) = \sum m(6, 7, 9, 10, 13) + d(1, 4, 5, 11, 15)$. **(10 Marks)**

b. Consider the following Boolean equation :
$F(A, B, C, D) = \sum m(1, 3, 7, 11, 15) + \sum d(0, 2, 5)$.
Simplify the function F using a 3 variable MEV k – map. Assign the variable D to be the MEV. **(10 Marks)**

3 a. Implement the Boolean functions :
$F_1(x, y, z) = X\overline{Y} + YZ$
$F_2(x, y, z) = \pi m(0,3,5)$
Using a 3 – 8 line decoder IC 74138 with active low outputs. **(08 Marks)**

b. Interface a 10 key keypad to a digital system using a IC 74147 which is a 10 line to BCD priority encoder. Draw the logic diagram and explain the operation with the truth table. **(12 Marks)**

4 a. Implement the Boolean function :
$F(A, B, C, D) = \sum m(0, 1, 2, 4, 5, 7, 8, 9)$
Using a 8 to 1 multiplexer. Draw the logic diagram and explain the operation. Additional gates can be used if required. **(08 Marks)**

b. Explain the operation of a full subtractor with the help of a truth table and Boolean expressions for the outputs. Implement the full subtractor using two numbers of
i) 4 to 1 multiplexers
ii) 2 to 1 multiplexers.
Additional gates if required can be used. **(08 Marks)**

c. Design a one bit binary comparator. **(04 Marks)**

PART – B

5 a. Explain the operation of a gated SR latch with a logic diagram and a truth table. **(06 Marks)**

b. Explain the operation of a positive edge trigged 'D' flip-flop with the help of a logic diagram and truth table. Also draw the relevant waveforms. **(04 Marks)**

c. Draw the output waveforms Q_M and Q_S the outputs of the master and the slave respectively, if the inputs to a master slave JK flip-flop one as indicated below. **(10 Marks)**

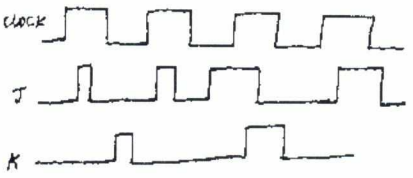

Fig. Q5(c)

6 a. Design a 4 bit binary ripple up counter using negative edge triggered JK flip-flops. Draw the timing diagram with respect to the input cock pulses. Explain the operation. **(10 Marks)**

b. Design a synchronous counter using clocked JK flip-flop for the counting sequence shown below :

Q_2	Q_1	Q_0
0	0	0
0	1	0
0	1	1
1	1	0
1	0	1
0	0	1
0	0	0

(10 Marks)

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

b. Design a synchronous circuit using positive edge triggered JK flip-flops to generate the following sequence :
0 – 1 – 2 – 0 is input x = 0 and
0 – 2 – 1 – 0 is input x = 1
Provide an output which goes high to indicate the non – zero states in the 0 – 1 – 2 – 0 sequence. **(12 Marks)**

8 Construct the excitation table, transition table, state table and state diagram for the sequential circuit shown in Fig. Q8. **(20 Marks)**

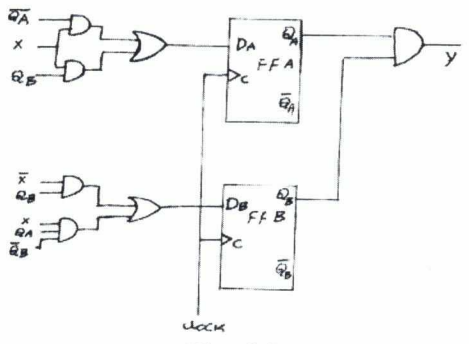

Fig. Q8

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10ES34

Third Semester B.E. Degree Examination, June/July 2015

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. Derive expression for
i) Star to delta transformation ii) Delta to star transformation **(10 Marks)**

b. For the Network shown find the node voltages Vd and Vc Fig. Q No. 1 (b). **(10 Marks)**

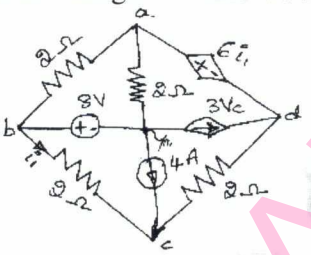


Fig.Q1(b)

2 a. Define the following with examples
i) Oriented graph ii) Tree iii) Fundamental cut set iv) Fundamental tie set **(08 Marks)**

b. For the network, Shown Fig. Q No.2 (b) write the tie set schedule, tie set matrix and obtain equilibrium equation in matrix form using KVL. Calculate branch currents and branch voltage. Follow the same orientation and branch numbers use 4, 5 and 6 as tree branches. **(12 Marks)**

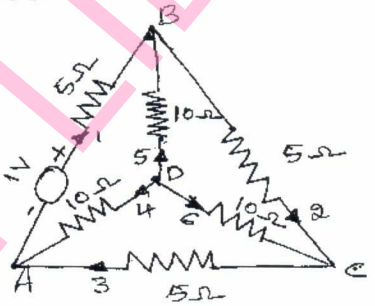


Fig.Q2(b)

3 a. State and prove Reciprocity theorem. **(07 Marks)**

b. Find the output voltage Eo of the Network shown Using Millman's theorem. Fig. Q No. 3(b)

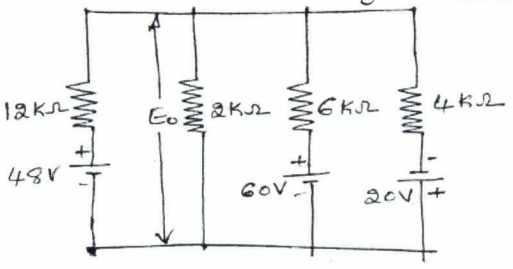
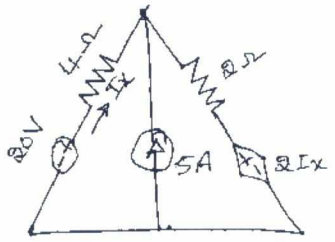


Fig.Q3(b)

(06 Marks)

c. Using superposition theorem, find the current IX the network shown in Fig. Q No.3(c)

Fig.Q3(c)

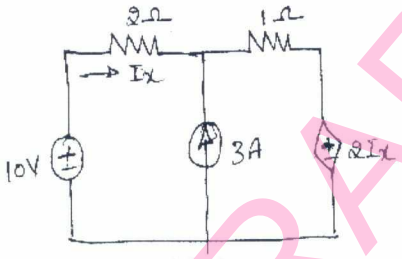


(07 Marks)

4 a. State Norton's theorem. Show that Thevenin's equivalent circuit is the dual of Norton's equalent circuit. **(06 Marks)**

b. Obtain the current I_x by using Thevenin's theorem for the network shown in Fig Q No.4(b)

Fig.Q4(b)



(08 Marks)

c. State maximum power transfer theorem. Prove that $Z_L = Z_o^*$ for Ac circuits. **(06 Marks)**

PART – B

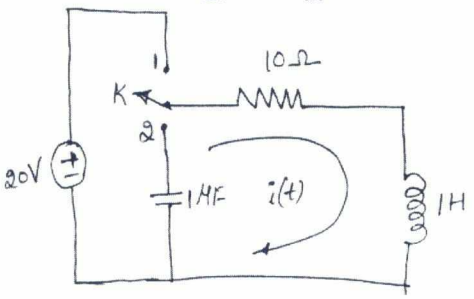
5 a. Show that $f_0 = \sqrt{f_1 f_2}$ fro series Resonance circuit. **(06 Marks)**

b. A voltage of 100 sin wt is applied to an RLC series circuit at resonant frequency. The voltage across a capacitor was found to be 400V. The bandwidth is 75Hz. The impedence at resonance is 100Ω. Find the resonant frequency and constants of the circuit. **(06 Marks)**

c. Derive an expression for the resonant frequency of a resonant frequency of a resonant circuit consisting of R_L L in parallel with R_c C. Draw the frequency response curve of the above circuit. **(08 Marks)**

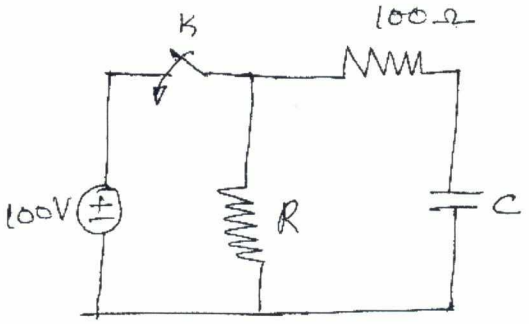
6 a. In the circuit shown, switch K is changed from 1 to 2 at t = 0, steady state having been attained in position 1. Find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(10 Marks)**

Fig.Q6(a)



b. In the circuit shown, switch K is kept open for very long time, on closing K, after 10ms, Vc = 80V. Then the switch K is kept closed for a long time. When the switch is opened again, Vc = 90V after half second, calculate values of R and C. Fig. Q No.6 (b)

Fig.Q6(b)

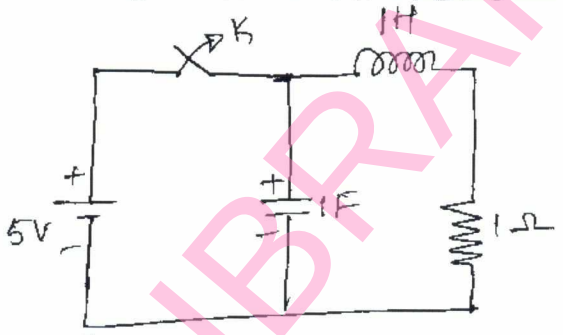


(10 Marks)

7 a. State and prove i) Initial value theorem ii) Final value theorem as applied to Laplace transform. What are the limitations of each theorem. **(10 Marks)**

b. In the circuit shown, in Fig.Q No.7 (b) switch is initially closed. After steady the switch is opened, Determine the nodal voltages V_a (t) and V_b (t) using Laplace transform method.

Fig.Q7(b)



(10 Marks)

8 a. Define z-parameters. Express z-parameters in terms of y – parameters. **(10 Marks)**

b. Find y parameters and z parameters for the circuit shown.

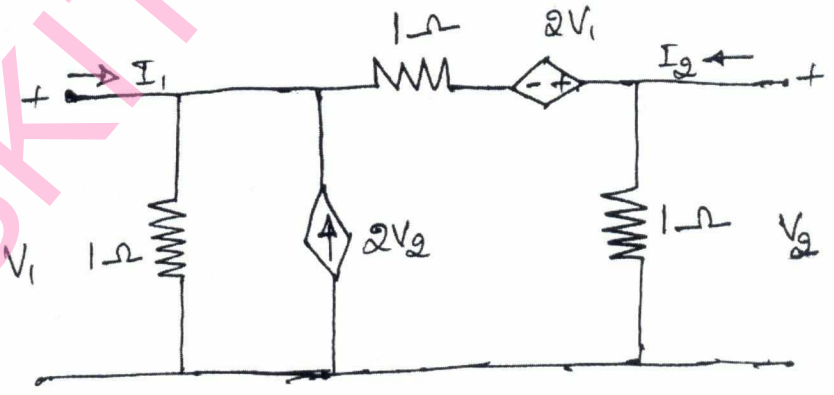


Fig.Q8(b) **10 Marks)**

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10EE35

Third Semester B.E. Degree Examination, June/July 2015
Electrical and Electronic Measurements and Instrumentation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive the dimensions of Resistance, Inductance and Capacitance in LMT and I system of units. **(04 Marks)**

b. Derive an expression for bridge sensitivity for a wheat stone bridge. **(08 Marks)**

c. A very small resistance of approximately 50 μΩ is measured using Kelvin's double bridge. At balance, the value of the standard resistance is 100.05μΩ, resistance of the inner ratio arms are 100.51Ω and 200Ω respectively, the resistance of the outer ratio arms are 100.4Ω and 200Ω respectively. The resistance of the interlink is 800μΩ. Calculate the magnitude of the error in the measurement. **(04 Marks)**

d. What are the advantages of SI over other system of units? **(04 Marks)**

2 a. Obtain the balance equation for Maxwell's Inductance Capacitance bridge used for measurement of unknown inductance. Draw the phasor diagram at balance condition. **(10 Marks)**

b. Explain the fall of potential method used for the measurement of earth resistance. **(06 Marks)**

c. Mention types of sources and detectors used in AC bridges. **(04 Marks)**

3 a. Compare Current Transformer and Potential Transformer. **(05 Marks)**

b. A current transformer with a bar primary has 500 turns in the secondary winding. The secondary circuit burden is (2+j1)Ω with 5A flowing in the secondary winding. The magnetizing m.m.f is 80A and the iron loss is 1.6W. Determine the ratio and phase angle errors. Find also the maximum value of the flux density in the core. **(10 Marks)**

c. What are the advantages of Instrument transformer? **(05 Marks)**

4 a. Explain with a neat figure, construction and working of dynometer type Wattmeter. **(08 Marks)**

b. Explain with the help of neat sketch, construction of induction type energy meter. **(08 Marks)**

c. The name plate of a single phase energy meter reads as 250V, 20A, 1800 rev/kwh. The meter is tested at $3/4^{th}$ load and U.P.F. The meter makes 20 Revolutions in 10 seconds. Determine the % error in the reading of the energy meter. **(04 Marks)**

PART – B

5 a. With the help of a neat diagram, explain the construction of Weston frequency meter. **(08 Marks)**

b. With the help of block diagram, explain the Ramp – type digital voltmeter. **(06 Marks)**

c. With the block diagram, explain TRUE RMS reading voltmeter. **(06 Marks)**

6 a. Explain with the help of block diagram, working of digital storage oscilloscope and what are its advantages. **(10 Marks)**

b. Explain in brief front panel details of a dual trace oscilloscope. **(06 Marks)**

c. Calculate the sampling rate for 1KHz and the 10KHz signal if the time base setting is adjusted to display 10 cycles on the screen. **(04 Marks)**

7 a. Prove that gauge factor of strain gauge is given by $K = 1 + 2\mu$, where 'μ' is the Poisson's ratio. **(08 Marks)**

b. Explain Photo Voltaic cells. **(04 Marks)**

c. Explain the principle and working of LVDT. **(08 Marks)**

8 a. Explain with the help of diagram, the operation of X – Y recorders. **(06 Marks)**

b. Explain the working of function generator with the help of neat diagram. **(07 Marks)**

c. Explain briefly Data acquisition system. **(07 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June/July 2015
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Express the complex number $\frac{(5-3i)(2+i)}{4+2i}$ in the form x + iy. **(06 Marks)**

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

c. Find the cube roots 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 $\frac{x}{(x+1)(2x+3)}$. **(07 Marks)**

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

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

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

c. Using Maclcaurin's series expand $\log(1 + x)$ upto the term containing x^4. **(07 Marks)**

4 a. If $u = f(x + ct) + g(x - ct)$ show that $\frac{\partial^2 u}{\partial t^2} = c^2\frac{\partial^2 u}{\partial x^2}$. **(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. If $u = x + y$, $v = y + z$, $w = z + x$ find the value of $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. **(07 Marks)**

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

b. Evaluate $\int_0^a \frac{x^4}{\sqrt{a^2 - x^2}}dx$. **(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 beta and gamma functions and prove that $\Gamma(n + 1) = n\Gamma(n)$. **(06 Marks)**

b. Show that $\int_0^{\pi/2}\sqrt{\sin\theta}\, d\theta \times \int_0^{\pi/2}\frac{1}{\sqrt{\sin\theta}}d\theta = \pi$. **(07 Marks)**

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

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

b. Solve : $(x^2 - y^2)\,dx - xydy = 0$. **(07 Marks)**

c. Solve : $\frac{dy}{dx} + y\cot x = 4x\,\text{cosec}\,x$. **(07 Marks)**

8 a. Solve : $(D^3 - 6D^2 + 11D - 6)\,y = 0$. **(06 Marks)**

b. Solve : $(D^2 + 2D + 1) = x^2 + e^{+x}$. **(07 Marks)**

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

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