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10MAT31

Third Semester B.E. Degree Examination, June/July 2014
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find Fourier series of $f(x) = 2\pi x - x^2$ in $[0, 2\pi]$. Hence deduce $\sum_{1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$. Sketch the graph of f(x). **(07 Marks)**

b. Find Fourier cosine series of $f(x) = \sin\left(\frac{m\pi}{\ell}\right)x$, where m is positive integer. **(06 Marks)**

c. Following table gives current (A) over period (T):

A (amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98
t (sec)	0	T/6	T/3	T/2	2T/3	5T/6	T

Find amplitude of first harmonic. **(07 Marks)**

2 a. Find Fourier transformation of $e^{-a^2x^2}$ $(-\infty < x < \infty)$ hence show that $e^{-x^2/2}$ is self reciprocal. **(07 Marks)**

b. Find Fourier cosine and sine transformation of

$$f(x) = \begin{cases} x & 0 < x < a \\ 0 & x \geq a \end{cases}$$ **(06 Marks)**

c. Solve integral equation $\int_0^\infty f(x)\cos sx\,dx = \begin{cases} 1-s & 0 < s < 1 \\ 0 & s \geq 1 \end{cases}$. Hence deduce $\int_0^\infty \frac{1-\cos x}{x^2}dx = \frac{\pi}{2}$. **(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) = u(x, 0) = 0; $u(x, a) = \sin\left(\frac{\pi x}{\ell}\right)$. **(07 Marks)**

4 a. The revolution (r) and time (t) are related by quadratic polynomial $r = at^2 + bt + c$. Estimate number revolution for time 3.5 units, given

Revolution	5	10	15	20	25	30	35
Time	1.2	1.6	1.9	2.1	2.4	2.6	3

(07 Marks)

b. Solve by graphical method,
Minimize $Z = 20x_1 + 10x_2$ under the constraints $2x_1 + x_2 \geq 0$; $x_1 + 2x_2 \leq 40$; $3x_1 + x_2 \geq 0$; $4x_1 + 3x_2 \geq 60$; $x_1, x_2 \geq 0$. **(06 Marks)**

c. A company produces 3 items A, B, C. Each unit of A requires 8 minutes, 4 minutes and 2 minutes of producing time on machine M_1, M_2 and M_3 respectively. Similarly B requires 2, 3, 0 and C requires 3, 0, 1 minutes of machine M_1, M_2 and M_3. Profit per unit of A, B and C are Rs.20, Rs.6 and Rs.8 respectively. For maximum profit, how many number of products A, B and C are to be produced? Find maximum profit. Given machine M_1, M_2, M_3 are available for 250, 100 and 60 minutes per day. **(07 Marks)**

PART – B

5 a. By relaxation method, solve $-x+6y+27z=85$, $54x+y+z=110$, $2x+15y+6z=72$. **(07 Marks)**

b. Using Newton Raphson method derive the iteration formula to find the value of reciprocal of positive number. Hence use to find $\frac{1}{e}$ upto 4 decimals. **(06 Marks)**

c. Using power rayley method find numerical largest eigen value and corresponding eigen vector for $\begin{bmatrix} 10 & 2 & 1 \\ 2 & 10 & 1 \\ 2 & 1 & 10 \end{bmatrix}$ using $(1, 1, 0)^T$ as initial vector. Carry out 10 iterations. **(07 Marks)**

6 a. Fit interpolating polynomial for f(x) using divided difference formula and hence evaluate f(z), given f(0) = - 5, f(1) = -14, f(4) = -125, f(8) = -21, f(10) = 355. **(07 Marks)**

b. Estimate t when f(t) = 85, using inverse interpolation formula given : **(06 Marks)**

t	2	5	8	14
f(t)	94.8	87.9	81.3	68.7

c. A solid of revolution is formed by rotating about x-axis, the area between x-axis, lines x = 0, x = 1 and curve through the points with the following co-ordinates.

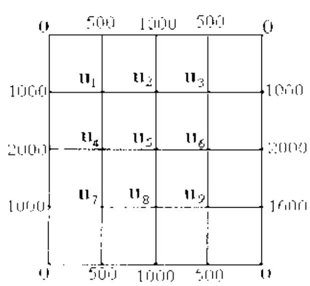
x	0	1/6	2/6	3/6	4/6	5/6	1
y	0.1	0.8982	0.9018	0.9589	0.9432	0.9001	0.8415

by Simpson's 3/8th rule, find volume of solid formed. **(07 Marks)**

7 a. Using the Schmidt two-level point formula solve $\frac{\partial^2 u}{\partial x^2}=\frac{\partial u}{\partial t}$ under the conditions $u(0,t)=u(1,t)=0$; $t\geq 0$; $u(1,0)=\sin \pi x$ $0<x<1$, take $h=\frac{1}{4}$ $\alpha=\frac{1}{6}$. Carry out 3 steps in time level. **(07 Marks)**

b. Solve the wave equation $\frac{\partial^2 u}{\partial t^2}=4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0,t)=u(4,t)=u_t(x,0)=0$, $u(x,0)=x(4-x)$ take h = 1 k = 0.5. **(06 Marks)**

c. Solve $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ in the square mesh. Carry out 2 iterations. **(07 Marks)**



8 a. State and prove recurrence relation of f-transformation hence find $Z_T(n)$, $Z_T(n^2)$. **(07 Marks)**

b. Find $Z_T\{e^{n\theta}\cosh n\theta-\sin(nA+\theta)+n\}$. **(06 Marks)**

c. Solve difference equation $u_{n+2}+6u_{n+1}+9u_n=n2^n$ given $u_0=u_1=0$. **(07 Marks)**

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Third Semester B.E. Degree Examination, June/July 2014
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. With respect to a semiconductor diode, explain the following:
i) Transition and diffusion capacitance.
ii) Reverse recovery time. **(06 Marks)**

b. Explain the operation of the circuit shown in Fig.Q.1(b). Draw output waveform and transfer characteristic. [Assume ideal diode]. **(07 Marks)**

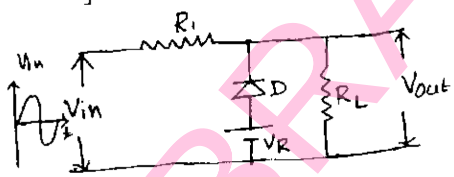

Fig.Q.1(b)

c. Write the procedure for analyzing the clamping circuit. Determine output voltage for the network shown in Fig.Q.1(c). Assume f = 1000Hz and ideal diode. **(07 Marks)**

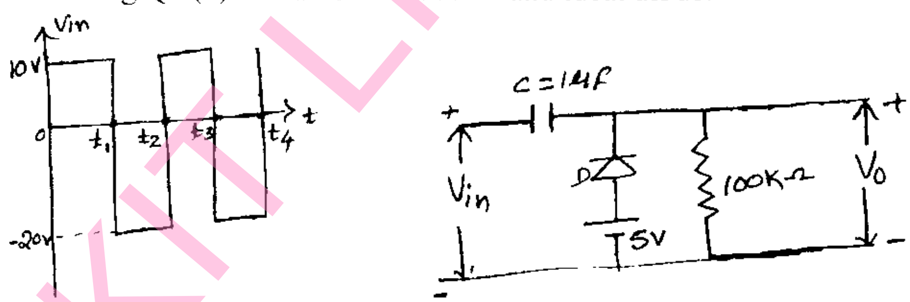

Fig.Q.1(c)

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

b. With circuit diagram, explain Emitter stabilized bias circuit. Write the necessary equation. **(07 Marks)**

c. For the circuit shown in Fig.Q.2(c), find I_C, V_B, V_E, R_1 and $S_{(ICO)}$. **(07 Marks)**

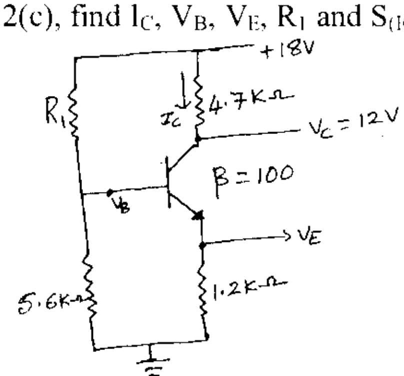

Fig.Q.2(c)

3 a. Draw the circuit diagram of common Emitter fixed bias configuration. Derive the expression for Z_i, Z_o, A_v using re model. **(08 Marks)**

b. For the network shown in Fig.Q.3(b), determine r_e, Z_i, Z_o, A_v and A_I. **(06 Marks)**

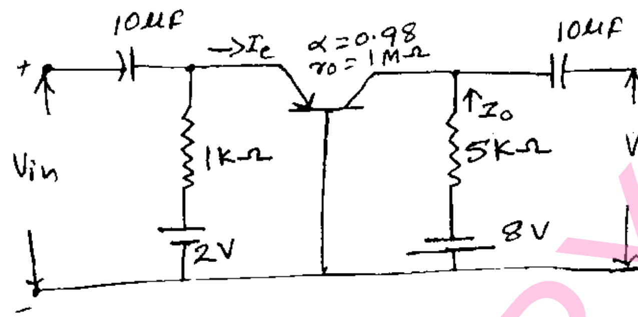

Fig.Q.3(b)

c. What are the advantages of h-parameters? **(06 Marks)**

4 a. Discuss the effect of various capacitors on frequency response. **(04 Marks)**

b. What is Miller effect? Prove that Miller effect capacitance $C_{mi} = (1 - A_v) C_f$ and $C_{mo} = \left(1 - \frac{1}{A_v}\right) C_f$. **(08 Marks)**

c. Determine the high frequency response of the amplifier circuit shown in Fig.Q.4(c). Draw the frequency response curve. **(08 Marks)**

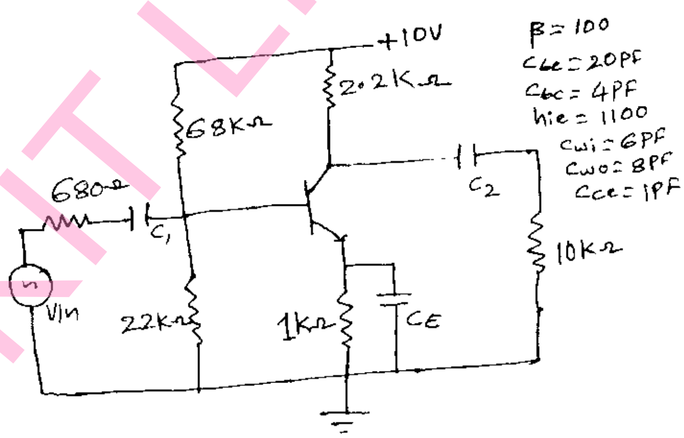

Fig.Q.4(c)

PART – B

5 a. Explain the need of cascading amplifier? Draw and explain the block diagram of two-stage cascade amplifier. **(04 Marks)**

b. With block diagram, explain the concept of feedback amplifier. If an amplifier has mid-band voltage gain (A_v mid) of 1000 with $f_L = 50$Hz and $f_H = 50$ kHz, if 5% feedback is applied then calculate f_L and f_H with feedback. **(08 Marks)**

c. Derive the expression for input resistance (R_{if}) for feedback amplifier employing current-series feedback. **(08 Marks)**

6 a. A series fed class-A amplifier shown in Fig.Q.6(a) operates from dc source and applied sinusoidal input signal generates peak base current 9 mA. Calculate I_{CQ}, V_{CEQ}, P_{DC}, P_{ac} and efficiency. Assume $\beta = 50$ and $V_{BE} = 0.7V$. **(06 Marks)**

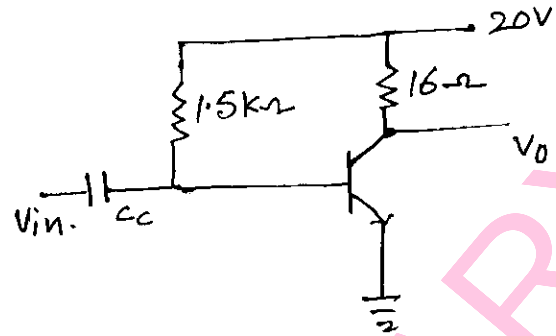

Fig.Q.6(a)

b. What is harmonic distortion? Explain the three point method of calculating the second harmonic distortion. **(08 Marks)**

c. Explain the working of complementary symmetry class-B amplifier. **(06 Marks)**

7 a. With circuit diagram, explain RC-phase shift oscillator using BJT. **(08 Marks)**

b. In a transistorized Hartley oscillator the two inductances are 2mH and 20μH, while the frequency is to be changed from 950kHz to 2050 kHz. Calculate the range over which the capacitor is to be varied. **(04 Marks)**

c. With circuit diagram, explain the working principle of crystal oscillator in series resonant mode. A crystal has the following parameters L = 0.334H, C = 0.065pF and R = 5.5KΩ. Calculate the resonant frequency. **(08 Marks)**

8 a. Compare FET over BJT. **(06 Marks)**

b. With equivalent circuit obtain the expression for Z_i and Z_o for JFET self bias with unbypassed R_s. **(08 Marks)**

c. The fixed bias configuration shown in Fig.Q.8(c) has $V_{GSQ} = -2V$, $I_{DQ} = 5.625mA$ with $I_{DSS} = 10mA$, $V_p = -8V$ and $Y_{DS} = 40\mu s$ determine g_m, r_d, Z_o and A_v. **(06 Marks)**

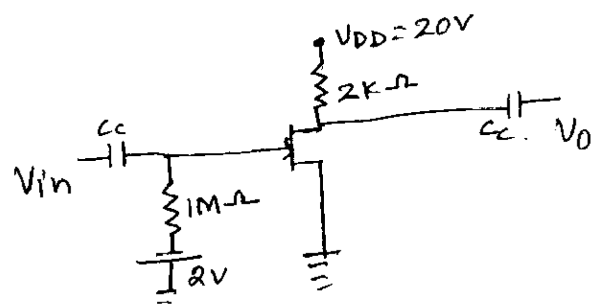

Fig.Q.8(c)

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10ES33

Third Semester B.E. Degree Examination, June/July 2014

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. $A_8A_4A_2A_1$ is an 8421 BCD input to a logic circuit whose output is a 1 when $A_8 = 0$, $A_4 = 0$ and $A_2 = 1$, or when $A_8 = 0$ and $A_4 = 1$. Design the simplest possible logic circuit. **(08 Marks)**

b. Simplify the given function using K-MAP
$\sum m(0, 2, 3, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 26, 27)$. **(06 Marks)**

c. Design a three-input, one-output minimal two-level gate combinational circuit which has an output equal to 1 when majority of its inputs are at logic 1 and has an output equal to 0 when majority of its inputs are at logic 0. **(06 Marks)**

2 a. Find a minimal sum for the following Boolean function using decimal Quine-Moclusky method and prime implicant table reduction $F = \sum(1, 2, 3, 5, 6, 7, 8, 9, 12, 13, 15)$. **(10 Marks)**

b. For the given Boolean function, determine a minimal sum using MEV techniques using a, b, c as the map variables $f = \sum(3, 4, 5, 6, 7, 8, 9, 12, 13, 15)$. **(05 Marks)**

c. Find a minimal sum for the following Boolean function using MEV technique with a, b and c as the map variables $f(\alpha, \beta, a, b, c) = \alpha\bar{a}\bar{b}\bar{c} + \alpha\bar{a}\bar{b}c + \alpha a\bar{b}c + \bar{\beta}\bar{a}\bar{b}c + \beta\bar{a}b\bar{c} + \bar{a}bc + a\bar{b}\bar{c}$. **(05 Marks)**

3 a. Develop the logic diagram of a 2 to 4 decoder with the following specifications:
i) Active low enable input; ii) Active high encoded outputs. Draw the IEEE symbol. **(06 Marks)**

b. Design a combinational circuit to convert BCD to excess – 3. **(08 Marks)**

c. Write the condensed truth table for 0, 4, to 2 line priority encoder with a valid output where the highest priority is given to the highest bit position or input with highest index and obtain the minimal sum expressions for the outputs. **(06 Marks)**

4 a. How does the look-ahead carry adder speed up the addition process? **(10 Marks)**

b. Implement a 12-bit comparator using IC7485. **(04 Marks)**

c. Implement $u = ad + b\bar{c} + bd$, using and 4 – 1 MUX using ab as select inputs. **(06 Marks)**

PART – B

5 a. Explain the working of pulse-triggered JK flip-flop with typical JK flip-flop waveforms. **(08 Marks)**

b. Explain switch debouncer using S-R latch with waveforms associated with switch debouncer. **(08 Marks)**

c. How do you convert J-K flip-flop to S-R flip-flop? **(04 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 the working of universal shift register with the help of logic diagram and mode control table. **(10 Marks)**

b. Design a synchronous counter to count from 0000 to 1001 using JK flip-flops. **(10 Marks)**

7 a. A sequential circuit has two flip-flop A and B, two inputs x and y, and an output Z. The flip-flop input function and the circuit output functions are as follows:

$J_A = xB + \overline{y}\overline{B}$; $K_A = x\overline{y}\overline{B}$; $J_B = x\overline{A}$; $K_A = x\overline{y} + A$; $Z = xyA + \overline{x}\overline{y}B$. Obtain the logic diagram, state-table and state equations, also state diagram. **(10 Marks)**

b. Realize the system represented by the state diagram shown in Fig.Q.7(a). Using D-flip-flop. **(10 Marks)**

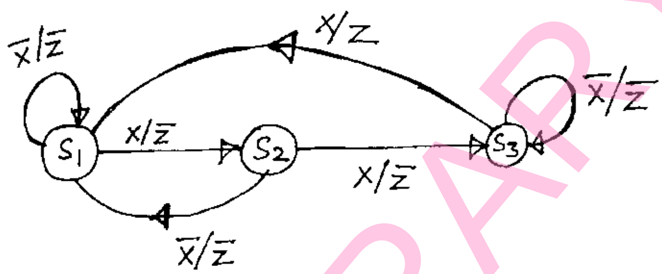

Fig.Q.7(a)

8 a. Design and implement a synchronous 3 bit up/down counter using J-K flip flops. **(10 Marks)**

b. What do you mean by the Moore model and Melay model of the state diagram? **(04 Marks)**

c. Draw the state diagram of a Mealy machine to detect as input sequence 10110 with overlap. An output 1 is to be generated when the sequence is detected. **(06 Marks)**

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Third Semester B.E. Degree Examination, June / July 2014
Network Analysis

Time: 3 hrs. Max. Marks:100

Note:1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Assume suitable missing data if any.***

PART – A

1 a. The node equations of a network are $\left[\frac{1}{5}+\frac{1}{2}j+\frac{1}{4}\right]V_1-\frac{1}{4}V_2=\frac{50\angle 0^\circ}{5}$ and $-\frac{1}{4}V_1+\left[\frac{1}{4}-\frac{1}{2j}+\frac{1}{2}\right]V_2=\frac{50\angle 90^\circ}{2}$. Derive the network. **(10 Marks)**

b. Find the current I in 28 Ω resistor by mesh analysis in Fig. Q1 (b). **(05 Marks)**

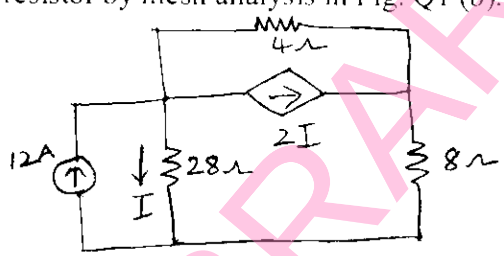

Fig. Q1 (b)

c. Using source transformation find power delivered by 50 V source in given network of Fig. Q1 (c). **(05 Marks)**

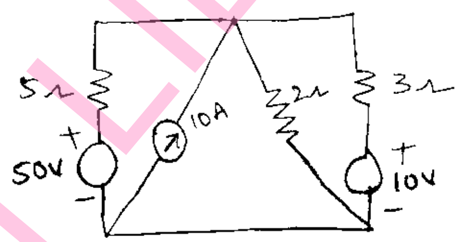

Fig. Q1 (c)

2 a. Define the following terms with respect to network topology and give examples:
i) Oriented and unoriented graphs.
ii) Isomorphic graphs.
iii) Fundamental cut set. **(06 Marks)**

b. For the network shown in Fig. Q2 (b), write the tie set schedule selecting centre star as tree and find all the branch currents by solving equilibrium equations. **(10 Marks)**

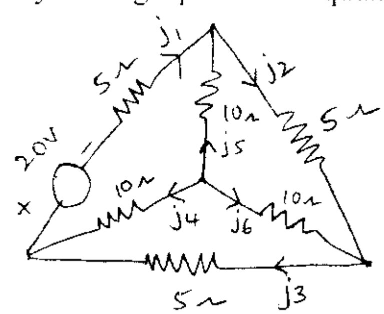

Fig. Q2 (b)

c. For the network shown in Fig. Q2 (c) draw the dual network. **(04 Marks)**

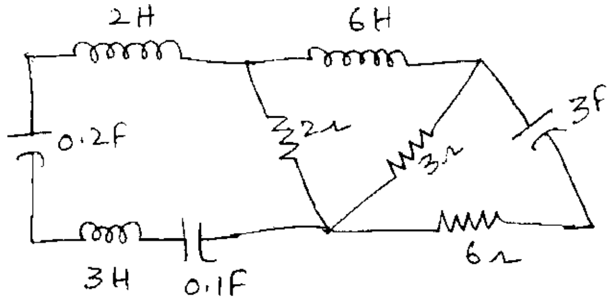

Fig. Q2 (c)

3 a. State and prove superposition theorem. **(06 Marks)**

b. Find i_x and hence verify reciprocity theorem for the network in Fig. Q3 (b). **(08 Marks)**

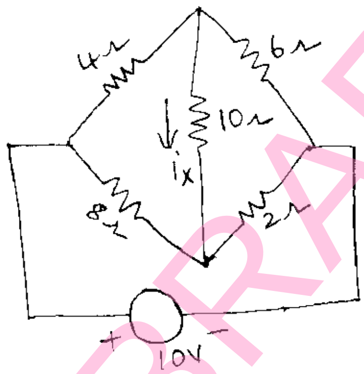

Fig. Q3 (b)

c. Using Millman's theorem find I_L through R_L for the network of Fig. Q3 (c). **(06 Marks)**

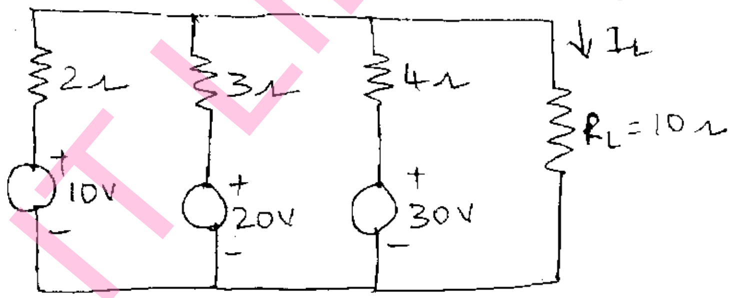

Fig. Q3 (c)

4 a. State and prove Thevenin's theorem. **(06 Marks)**

b. Find the value of load resistance when maximum power is transferred across it and also find the value of maximum power transferred for the network of Fig. Q4 (b). **(08 Marks)**

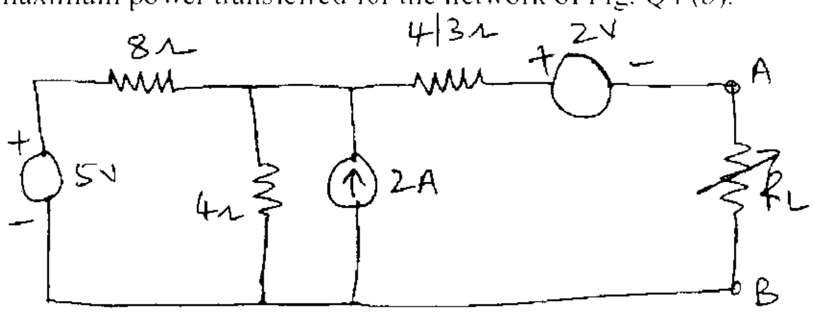

Fig. Q4 (b)

4 c. Find the current through 16 Ω resistor using Nortons theorem in Fig. Q4 (c). **(06 Marks)**

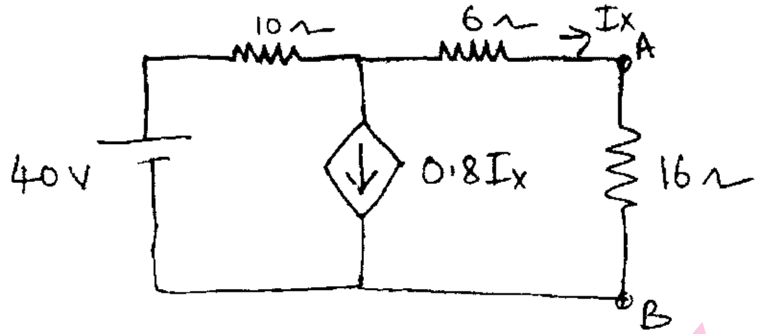

Fig. Q4 (c)

PART – B

5 a. Define the following terms: i) Resonance ii) Q-Factor iii) Selectivity of series RLC circuit iv) Bandwidth **(04 Marks)**

b. Prove that $f_0 = \sqrt{f_1 f_2}$ where f_1 and f_2 are the two half power frequencies of a resonant circuits. **(08 Marks)**

c. A series RLC circuit has R = 4 Ω, L = 1 mH and C = 10 μF. Calculate Q factor, band width, resonant frequency and the half power frequencies f_1 and f_2. **(08 Marks)**

6 a. For the circuit shown in Fig. Q6 (a), determine complete solution for current when switch K is closed at t = 0. Applied voltage is v(t) which is given as $100\cos\left(10^3 t + \frac{\pi}{2}\right)$. **(10 Marks)**

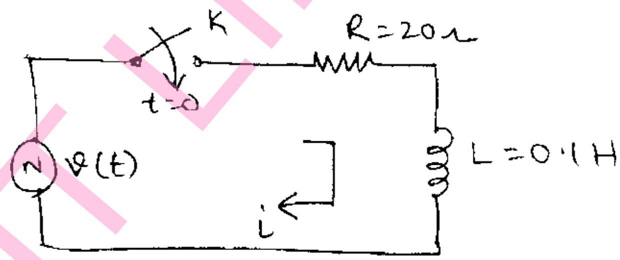

Fig. Q6 (a)

b. For the given circuit of Fig. Q6 (b) switch K is changed from position 1 to position 2 at t = 0, the steady state having been reached before switching. Find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(10 Marks)**

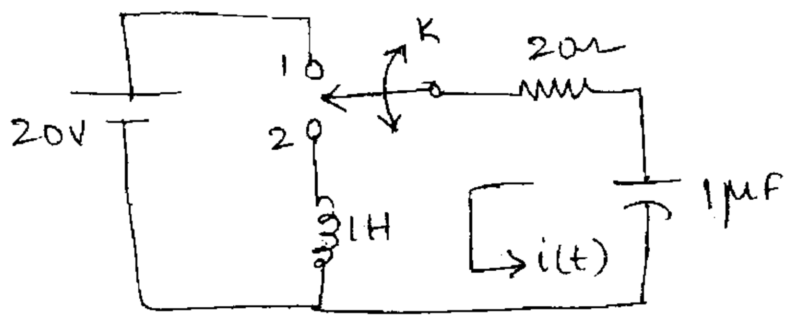

Fig. Q6 (b)

7 a. State and prove initial value and final value theorem. (08 Marks)

b. Obtain the Laplace transform of the saw tooth waveform shown in Fig. Q7 (b). (08 Marks)

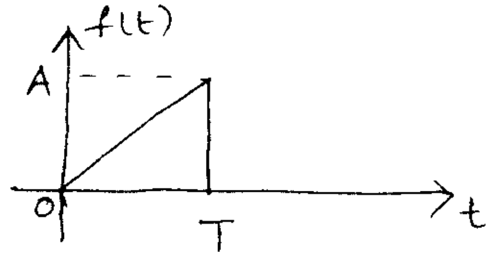

Fig. Q7 (b)

c. Find the Laplace transform of, (i) t (ii) $\delta(t)$. (04 Marks)

8 a. Obtain the relationship between h and y parameters of a two port network. (08 Marks)

b. Determine the transmission parameters for the network shown in Fig. Q8 (b). (08 Marks)

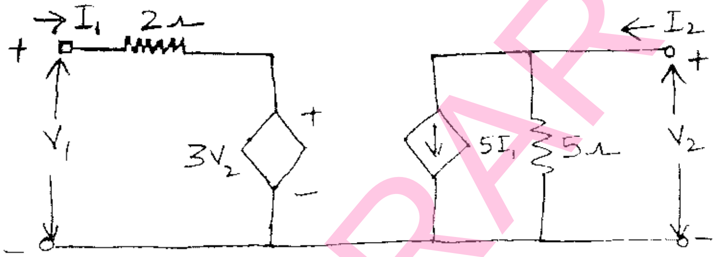

Fig. Q8 (b)

c. Define z parameters and draw the equivalent network in terms of z parameters. (04 Marks)

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10IT35

Third Semester B.E. Degree Examination, June/July 2014
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain with a neat block diagram of TRUE RMS voltmeters: **(10 Marks)**
b. Convert a basic D'Arsonal movement with an internal resistance of 50Ω and a full scale deflection current of 2mA into a multirange dc voltmeter with voltage range of 0 – 10V, 0 – 50V, 0 – 100V and 0 – 250V. Connect the multiplier resistances in series with D'Arsonal movement. **(10 Marks)**

2 a. With a neat block diagram, explain the successive approximation DVM. **(10 Marks)**
b. With a neat block diagram, explain the digital frequency meter. **(10 Marks)**

3 a. With a neat block diagram, explain the general purpose CRO. **(10 Marks)**
b. With a neat block diagram, explain the typical CRT connections. **(10 Marks)**

4 a. With a neat block diagram, explain the digital storage oscilloscope. **(10 Marks)**
b. With a neat block diagram, explain the sampling oscilloscope. **(10 Marks)**

PART – B

5 a. With a neat block diagram, explain the working principle of pulse generator. **(10 Marks)**
b. With a neat block diagram, explain the working principle of function generator. **(10 Marks)**

6 a. With a neat block diagram, explain the Wein's bridge to measure the frequency. **(10 Marks)**
b. With a neat block diagram, explain the Wagner's earth connections. **(10 Marks)**

7 a. Explain the construction and working of LVDT. **(10 Marks)**
b. Explain the construction and working of thermistor. What are the salient features of it. **(10 Marks)**

8 Explain the following with relevant sketch:
a. Photo electric transducer. **(07 Marks)**
b. Piezo electro transducer. **(06 Marks)**
c. RTD. **(07 Marks)**

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Third Semester B.E. Degree Examination, June/July 2014

Field Theory

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. State and explain Coulomb's law in vector form. **(04 Marks)**

b. Two point charges 20 nC and -20 nC are situated at (1, 0, 0)m and (0, 1, 0)m in free space. Determine electric field intensity at (0, 0, 1)m. **(05 Marks)**

c. A charge is uniformly distributed over a spherical surface of radius 'a'. Determine electric field intensity everywhere in space. Use Gauss law. **(06 Marks)**

d. State and prove divergence theorem. **(05 Marks)**

2 a. Determine the potential difference between two points due to a point charge 'q' at the origin. **(04 Marks)**

b. Derive point form of continuity equation. **(05 Marks)**

c. A metallic sphere of radius 10 cm has a surface charge density of 10 nC/m^2. Calculate electric energy stored in the system. **(06 Marks)**

d. The plane Z = 0 marks the boundary between free space and a dielectric medium with dielectric constant of 40. The $\hat{E}$ field next to the interface in free space is $\hat{E} = 13\hat{X} + 40\hat{Y} + 50\hat{Z}$ V/m. Determine $\hat{E}$ on the other side of the interface. **(05 Marks)**

3 a. State and prove uniqueness theorem. **(10 Marks)**

b. The two metal plates having an area 'A' and a separation 'd' form a parallel plate capacitor. The upper plate is held at a potential V_0 and lower plate is grounded. Determine:

i) Potential distribution

ii) The electric field intensity

iii) Capacitance of parallel plate capacitor. **(10 Marks)**

4 a. State and explain Ampere's circuital law. **(04 Marks)**

b. Explain scalar and vector magnetic potential. **(08 Marks)**

c. The magnetic field intensity is given by $\hat{H} = 0.1y^3\hat{X} + 0.4x\hat{Z}$ A/m. Determine current flow through the path $P_1(5, 4, 1) - P_2(5, 6, 1) - P_3(0, 6, 1) - P_4(0, 4, 1)$ and current density J. **(08 Marks)**

PART – B

5 a. Derive Lorentz's force equation. **(05 Marks)**

b. Obtain the expression for reluctance in a series magnetic circuit. **(05 Marks)**

c. Derive the magnetic boundary conditions at the interface between two different magnetic materials. **(06 Marks)**

d. A ferrite material is operating in linear mode with B = 0.05 T. Assume $\mu_r = 50$. Calculate magnetic susceptibility, magnetization and magnetic field intensity. **(04 Marks)**

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

b. Write a note on retarded potential. **(06 Marks)**

c. A circular conducting loop of radius 40 cm lies in xy plane and has resistance of 20Ω. If the magnetic flux density in the region is given as,

$$\hat{B} = 0.2\cos 500t\hat{X} + 0.75\sin 400t\hat{Y} + 1.2\cos 314t\hat{Z}T .$$

Determine effective value of induced current in the loop. **(06 Marks)**

7 a. Obtain solution of the wave equation for a uniform plane wave (UPW) in free space. **(06 Marks)**

b. Discuss uniform plane wave propagation in a good conducting media. **(06 Marks)**

c. State and prove Poynting theorem. **(08 Marks)**

8 a. Derive the expressions for transmission coefficient and reflection coefficient for a uniform plane wave with normal incidence at a plane dielectric boundary. **(08 Marks)**

b. Write a note on standing wave ratio (SWR). **(07 Marks)**

c. A 50 MHz uniform plane wave having electric field amplitude 10 V/m. The medium is lossless having $\epsilon_r = \epsilon_r^{l} = 9$ and $\mu_r = 1$. The wave propagates in the xy plane at a 30° angle to the x axis and is linearly polarized along z axis. Write the phasor expression for the electric field. **(05 Marks)**

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USN

MATDIP301

Third Semester B.E. Degree Examination, June/July 2014

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

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.

1 a. Find the modulus and amplitude of $\dfrac{5+3i}{4-2i}$ **(06 Marks)**

b. Prove that $(1+i)^n + (1-i)^n = 2^{\frac{n}{2}+1}\cos\dfrac{n\pi}{4}$ **(07 Marks)**

c. Prove that $\left(\dfrac{\cos\theta + i\sin\theta}{\sin\theta + i\cos\theta}\right)^4 = \cos 8\theta + i\sin 8\theta$ **(07 Marks)**

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

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

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

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

b. Find the pedal equation of the curve $r^n = a^n\cos n\theta$. **(07 Marks)**

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

4 a. If $z = \dfrac{x^2+y^2}{x+y}$, then show that $\left(\dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)^2 = 4\left(1 - \dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)$ **(07 Marks)**

b. If $u = \sin^{-1}\left(\dfrac{x^2+y^2}{x+y}\right)$, then prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \tan u$. **(06 Marks)**

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

5 a. Obtain the reduction formula for

$$I_n = \int_0^{\pi/2} \sin^n x\, dx$$ **(06 Marks)**

b. Evaluate $\displaystyle\int_0^{\pi}\int_{2\sin\theta}^{4\sin\theta} r^3\, dr\, d\theta$ **(07 Marks)**

c. Evaluate $\displaystyle\int_{-1}^{1}\int_0^{z}\int_{x-z}^{x+z}(x+y+z)\,dx\,dy\,dz$ **(07 Marks)**

6 a. With usual notations, prove that
$$\beta(m,n) = \frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$$
(06 Marks)

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

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

7 a. Solve $\frac{dy}{dx} = (4x + y + 1)^2$, if $y(0) = 1$. **(06 Marks)**

b. Solve $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$ **(07 Marks)**

c. Solve $\left\{y\left(1 + \frac{1}{x}\right) + \cos y\right\}dx + (x + \log x - x\sin y)dy = 0$ **(07 Marks)**

8 a. Solve: $(D^3 + D^2 + 4D + 4)y = 0$ **(06 Marks)**

b. Solve: $(D^2 - 5D + 1)y = 1 + x^2$ **(07 Marks)**

c. Solve: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = e^{2x}\sin x$ **(07 Marks)**

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