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10MAT31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the Fourier series for the function $f(x) = x + x^2$ over the interval $-\pi \le x \le \pi$. Hence deduce that:

i) $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \ldots$ ii) $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots$ **(07 Marks)**

b. Expand the function $f(x) = x(\pi - x)$ over the interval $(0, \pi)$ in half range Fourier cosine series. **(06 Marks)**

c. Find the constant term and the first two harmonics for the function $f(\theta)$ given by the following table: **(07 Marks)**

θ (in degrees)	0	60	120	180	240	300	360
$f(\theta)$	0.8	0.6	0.4	0.7	0.9	1.1	0.8

2 a. Show that the Fourier transform of the function

$$f(x) = \begin{cases} 1 - x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases} \quad \text{is} \quad F(\alpha) = \frac{2\sqrt{2}}{\alpha^3\sqrt{\pi}}(\sin\alpha - \alpha\cos\alpha).$$

Hence deduce that $\int_0^\infty \frac{\sin x - x\cos x}{x^3}\,dx = \frac{\pi}{4}$. **(07 Marks)**

b. Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. **(06 Marks)**

c. If the Fourier sine transform of f(x) is given by $F_s(u) = \frac{\pi}{2}e^{-2u}$, find the function f(x). **(07 Marks)**

3 a. Find the various possible solutions of two-dimensional Laplace equation by 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 one-dimensional heat equation $c^2 u_{xx} = u_t$, $0 < x < \pi$ subject to the conditions $u(0, t) = 0$, $u(\pi, t) = 0$, $u(x,0) = u_0 \sin x$ where u_0 is a non-zero constant. **(07 Marks)**

4 a. Find a curve of the best fit of the form $y = ax^b$ to the following data: **(07 Marks)**

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

b. For conducting a practical examination, the chemistry department of a college requires 10, 12 and 7 units of 3 chemicals x, y and z respectively. The chemicals are available in 2 types of boxes: Box A and Box B. Box A contains 3, 2 and 1 units of x, y, z respectively and cost Rs.300. Box B contains 1, 2 and 2 units of x, y, z respectively and costs Rs.200. Find how many boxes of each type should be bought by the department so that the total cost is minimum. Solve graphically. **(06 Marks)**

c. Solve the following LPP by simplex method:
Maximize $z = 2x_1 + 4x_2 + 3x_3$
Subject to the constraints $3x_1 + 4x_2 + 2x_3 \le 60$ $\quad 2x_1 + x_2 + 2x_3 \le 40$
$x_1 + 3x_2 + 2x_3 \le 80$ $\quad x_1, x_2, x_3 \ge 0$ **(07 Marks)**

PART – B

5 a. Use Newton-Raphson method to find an approximate root of the equation $x\log_{10} x = 1.2$ correct to 5 decimal places that is near 2.5. **(07 Marks)**

b. Use Relaxation method to solve the following system of linear equations:
$8x + 3y + 2z = 13 \qquad x + 5y + z = 7 \qquad 2x + y + 6z = 9$ **(06 Marks)**

c. Find the numerically largest eigen value and the corresponding eigen vector of the matrix
$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ by power method taking $X^{(0)} = [1 \quad 0 \quad 0]^T$. Perform 6 iterations. **(07 Marks)**

6 a. Find the interpolating polynomial for the function $y = f(x)$ given by $f(0) = 1$, $f(1) = 2$, $f(2) = 1$, $f(3) = 10$. Hence evaluate $f(0.75)$ and $f(2.5)$. **(07 Marks)**

b. Apply Lagrange's method to find the value of x corresponding to $f(x) = 15$ from the following data: **(06 Marks)**

x	5	6	9	11
f(x)	12	13	14	16

c. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $\frac{3}{8}^{th}$ rule dividing the interval (0, 1) into 6 equal parts. Hence deduce the approximate value of π. **(07 Marks)**

7 a. Solve the wave equation $u_{tt} = 4u_{xx}$ subject to the conditions $u(0, t) = 0$, $u(4, t) = 0$, $u_t(x, 0) = 0$ and $u(x, 0) = x(4 - x)$ by taking $h = 1$, $k = 0.5$ upto four steps. **(07 Marks)**

b. Find the numerical solution of the equation $u_{xx} = u_t$ when $u(0, t) = 0$, $u(1, t) = 0$, $t \ge 0$ and $u(x,0) = \sin \pi x$, $0 \le x \le 1$. Carryout computations for two levels taking $h = \frac{1}{3}$ and $k = \frac{1}{36}$. **(07 Marks)**

c. Solve Laplace's equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in the following Fig.Q7(c).

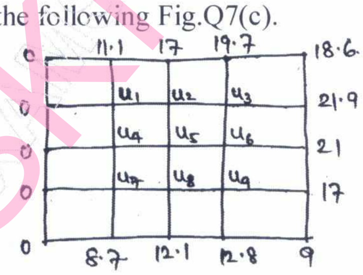

Fig.Q7(c) **(06 Marks)**

8 a. Find the z-transform of $5n^2 + 4\cos\frac{n\pi}{2} - 4^{n+2}$ and $\sinh n\theta$. **(06 Marks)**

b. Obtain in inverse z-transform of $\frac{z(2z+3)}{(z+2)(z-4)}$. **(07 Marks)**

c. Using z-transforms, solve $u_{n+2} + 3u_{n+1} + 2u_n = 3^n$ given $u_0 = 0$, $u_1 = 1$. **(07 Marks)**

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Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. Using Shockley's equation, determine the diode current at 25°C for a silicon diode with $I_S = 20$ pA and $V_D = 0.7$ V. Find the same when $V_D = 0.5$ V. **(04 Marks)**

b. Sketch the output waveform for the following circuit shown in Fig. Q1 (b), and plot the transfer characteristics - **(06 Marks)**

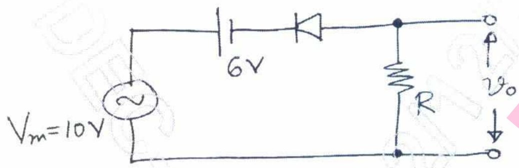


Fig. Q1 (b)

c. Check the condition for the following circuit shown in Fig. Q1 (c) to work as clamper. Sketch the output waveform. **(05 Marks)**

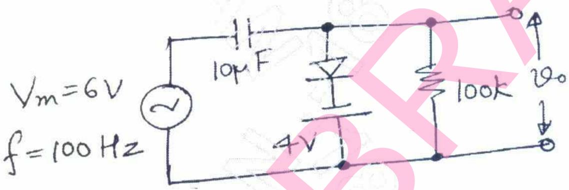


Fig. Q1 (c)

d. Find the current in the loop, the output voltage, and the power absorbed by each device. **(05 Marks)**

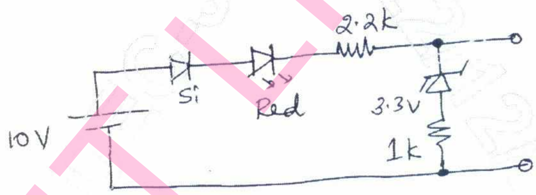


Fig. Q1 (d)

2 a. Derive the expression for I_B and V_{CE} of an emitter bias circuit. **(04 Marks)**

b. Check the condition for the approximate analysis of the voltage-divider bias circuit and obtain the Q-point using approximate analysis, given : $V_{CC} = +12$ V, $\beta = 120$, $R_C = 1.5$ KΩ, $R_E = 620$ Ω, $R_1 = 33$ kΩ and $R_2 = 4.7$ kΩ. Mark the Q-point on the DC load – line. **(06 Marks)**

c. Determine the values for the following circuit: V_E, I_E, V_{CE}, V_C, I_B and β. **(06 Marks)**

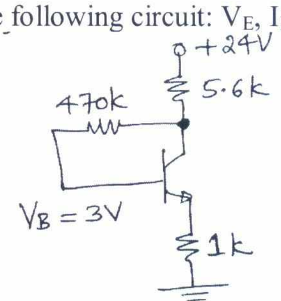


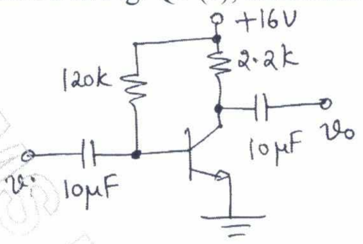
Fig. Q2 (c)

d. Design a fixed bias circuit for $V_{CC} = 10$ V, $\beta = 120$, $I_{C_Q} = 1.4$ mA and $V_{CE_Q} = 5$ V. **(04 Marks)**

3 a. Using r_e model, derive the expressions for Z_i, Z_o and A_V of a fixed bias circuit. **(06 Marks)**

b. Using exact analysis, determine Z_i, Z_o and A_V for the voltage-divider bias network if $R_1 = 220\ k\Omega$, $R_2 = 56\ k\Omega$, $R_C = 6.8\ k\Omega$, $R_E = 2.2\ k\Omega$, $\beta = 180$, $r_0 = 50\ k\Omega$ and $V_{CC} = 20V$. **(10 Marks)**

c. For the network shown in Fig. Q3 (c), determine Z_i, Z_o and A_V - **(04 Marks)**



$h_{fe} = 150$
$h_{ie} = 2.75\ k\Omega$
$h_{Oe} = 25\ \mu S$

Fig. Q3 (c)

4 a. Explain the frequency response curves for RC-coupled, transformer-coupled and direct-coupled amplifiers, with reasons for the drop in gain. **(09 Marks)**

b. Determine the mid-band gain and the lower cut-off frequencies f_{L_S} and f_{L_C} for the voltage-divider bias BJT amplifier with $C_S = 10\ \mu F$, $C_C = 10\ \mu F$, $R_S = 1\ k\Omega$, $R_1 = 36\ k\Omega$, $R_2 = 8.2\ k\Omega$, $R_E = 1.5\ k\Omega$, $R_C = 4.7\ k\Omega$, $R_L = 2.2\ k\Omega$, $\beta = 100$ and $V_{CC} = 20V$. **(11 Marks)**

PART – B

5 a. For a Darlington connection, derive the expressions for Z_i, Z_o, A_i and A_V. **(12 Marks)**

b. Mention the advantages and disadvantages of the negative feedback. **(04 Marks)**

c. Calculate the gain, input impedance and output impedance of a voltage-series-feedback amplifier having A = -300, $R_i = 1.5\ k\Omega$, $R_0 = 50\ k\Omega$ and $\beta = -\frac{1}{15}$. **(04 Marks)**

6 a. Enumerate the types of power amplifiers along with their efficiency, conduction angle and Q-point. **(05 Marks)**

b. Prove that the maximum efficiency of a class-B power amplifier is 78.5%. **(05 Marks)**

c. Calculate the efficiency of the following circuit shown in Fig. Q6 (c), for an input current swing of 10 mA. **(05 Marks)**

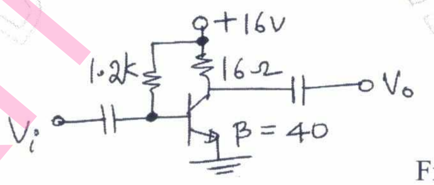


Fig. Q6 (c)

d. Along with the circuit diagram, explain the working of Class-C amplifier. **(05 Marks)**

7 a. Along with the circuit diagram, explain the working of a BJT phase-shift oscillator. **(06 Marks)**

b. Design a Wien-bridge oscillator for $f_0 = 6$ kHz, making suitable assumptions. **(06 Marks)**

c. Along with proper diagrams, explain the series resonant and parallel resonant crystal oscillators using BJT. **(08 Marks)**

8 a. Explain the operation of JFET amplifier using fixed bias. Draw the JFET small signal model, and derive the expressions for Z_i, Z_o and A_V. **(10 Marks)**

b. With necessary circit diagram, obtain the expressions for Z_i, Z_o and A_V for an E-MOSFET voltage-divider configuration. **(10 Marks)**

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Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Logic Design

Time: 3 hrs.   Max. Marks:100

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

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 – A

1 a. Represent the canonical minterm forms in decimal notation :

i) $f_1 = x\bar{y} + yz$

ii) $f_2 = \bar{a}c + bc\bar{d} + ad$. **(05 Marks)**

b. Show that $f(a, b, c, d) = \Sigma m(0, 1, 2, 5, 6, 8, 9, 10, 13, 14) = \pi M(3, 4, 7, 11, 12, 15)$. **(08 Marks)**

c. Simplify the following Boolean function and realize the simplified expression using basic gates.
$f(a, b, c, d, e) = \Sigma m(0, 1, 4, 8, 9, 11, 15, 16, 24, 26) + dm(10, 20, 22, 23, 25, 27, 31)$. **(07 Marks)**

2 a. Simplify the Boolean function $f(a, b, c, d) = \Sigma m(0, 1, 2, 7, 8, 9, 10, 13, 15)$ using Quine – Mc Cluskey tabulation method and verify the answer using k-map. **(10 Marks)**

b. Simplify the Boolean function $f(a, b, c, d) = \Sigma m(0, 2, 3, 4, 5, 8, 10, 11) + dm(7, 13, 14)$ using Map entered variable k-map. With "d" as map entered variable, verify the answer using k-map,. **(10 Marks)**

3 a. Design a combinational circuit using basic gates to convert excess 3 binary code to BCD code. **(10 Marks)**

b. Implement full adder using decoder. **(05 Marks)**

c. Design a 4 to 16 decoder using 3 to 8 decoders. **(05 Marks)**

4 a. Design a 4 bit BCD adder circuit using 7483IC with self correcting circuit. That is a provision to be made in the circuit, in case the sum of BCD exceeds 9. **(10 Marks)**

b. Realize the Boolean function $f(a, b, c) = \Sigma m(0, 1, 4, 5, 6)$ using 4 : 1 mux. **(05 Marks)**

c. Explain look – ahead carry adder and give its advantages and disadvantages. **(05 Marks)**

PART – B

5 a. Obtain characteristic equation of a S-R flip-flop. **(05 Marks)**

b. Explain the working of an universal shift register. **(05 Marks)**

c. Explain the working of a master –slave JK flip-flop with timing diagram for master and slave. Show how race around condition is eliminated. **(10 Marks)**

6 a. Design an asynchronous mod-8 counter using JK flip-flop and draw its timing diagram. **(10 Marks)**

b. Explain why asynchronous counter is called ripple counter. **(05 Marks)**

c. Explain mealy and Moore sequential circuit models. **(05 Marks)**

7 a. Draw and explain Moore JK flip-flop state diagram. **(05 Marks)**
b. For the state machine shown Fig.Q7(b) obtain : i) state table ii) Transition table iii) excitation table for JK flip–flop iv) logic diagram. **(15 Marks)**

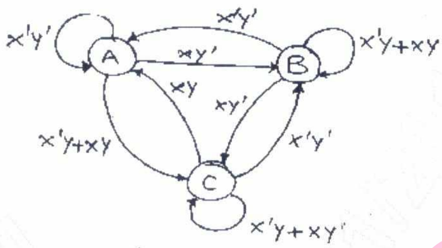

Fig.Q7(b)

8 a. Design a cyclic BCD up synchronous counter using T flip-flops. **(10 Marks)**
b. Design a cyclic synchronous counter using D flip-flops to generate a sequence of 5421 code. (Hint : 0, 1, 2, 3, 4, 8, 9, 10, 11, 12 0, 1 - - - -) sequence. **(10 Marks)**

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10ES34

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Network Analysis

Time: 3 hrs. Max. Marks:100

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

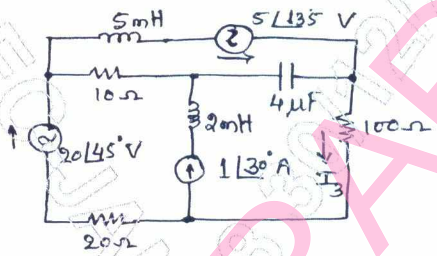
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Define the following terms with examples :
i) Lumped Element ii) Active Element iii) Practical Source. **(03 Marks)**

b. Find the current I_3 using mesh analysis for the circuit shown in fig.Q1(b), if the circuit is operating at frequency 5000 rad/s. **(07 Marks)**

Fig.Q1(b)

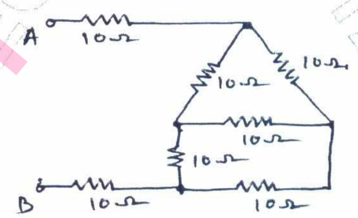


c. For the circuit shown in fig. Q1(c), find the power delivered by dependent source using node analysis. **(06 Marks)**

Fig.Q1(c)

d. Find the resistance R_{AB} for the network shown in fig.Q(d), using Δ - Y conversion. **(04 Marks)**

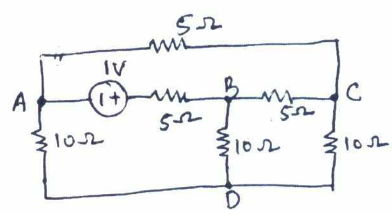
Fig.Q1(d)



2 a. Define the following terms with example :
i) Graph ii) Tree iii) Co - tree. **(03 Marks)**

b. For the circuit in fig.Q2(b), write the tie – set matrix using AB, BC and CA or the links of the tree. Obtain the equilibrium equations in matrix from using KVL and calculate all loop currents and branch voltages. **(10 Marks)**

Fig.Q2(b)



c. Draw the oriented graph for the circuit shown in fig.Q2(c). Also find fundamental cut – set schedule using X_{c1} , R_2 and X_{L1} or the twigs of the tree. Find admittance matrix also. **(04 Marks)**

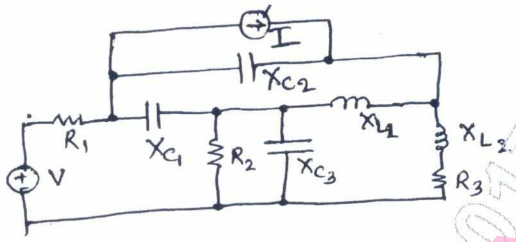


Fig.Q2(c)

d. Find the dual of the circuit shown in fig.Q2(d). **(03 Marks)**

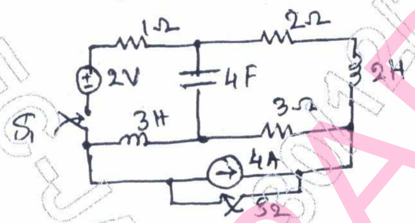


Fig.Q2(d)

3 a. Find V_x using superposition for the circuit shown in fig.Q3(a). **(08 Marks)**

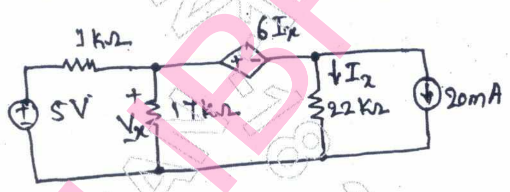


Fig.Q3(a)

b. Find the voltage V_L across the inductor and verify reciprocity theorem for the circuit shown in Fig.Q3(b). **(06 Marks)**

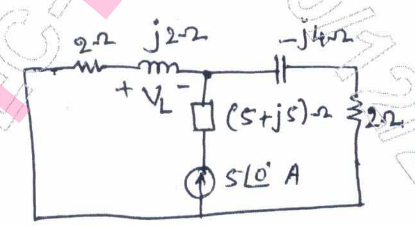


Fig.Q3(b)

c. State and prove Milliman's theorem. **(06 Marks)**

4 a. Find the Thevenin's equivalent circuit across terminals a & b for the circuit shown in fig.Q4(a). Also find the current I_L using this equivalent circuit. **(08 Marks)**

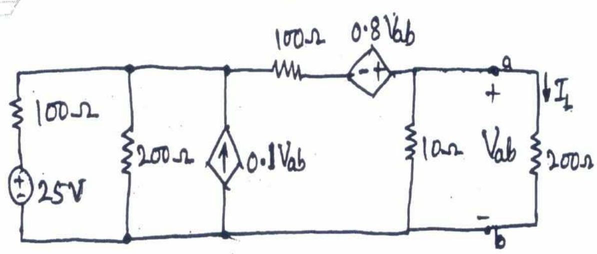
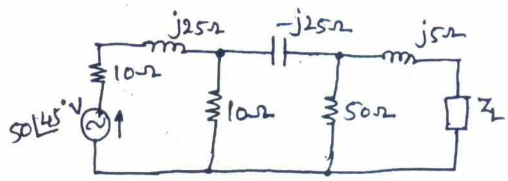


Fig.Q4(a)

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

c. Find Z_L for maximum power transfer for the circuit shown in fig.Q4(c). And also find the average maximum power absorbed by Z_L. **(07 Marks)**

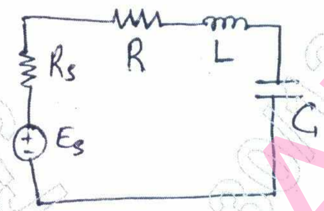
Fig.Q4(c)



PART – B

5 a. For the circuit shown in fig.Q5(a), find the transfer function, resonant frequency half power frequencies , bandwidth and Q - factor. **(10 Marks)**

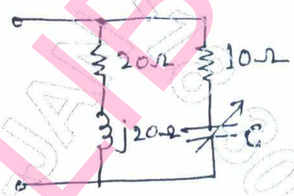
Fig.Q5(a)



b. Define the term Q – factor. Using this definition find the Q – factor of an inductor and a capacitor. **(05 Marks)**

c. For the network shown in fig.Q5(c), find the value of C for resonance to take place at w = 5000 rad/s. **(05 Marks)**

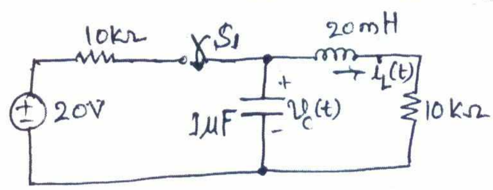
Fig.Q5(c)



6 a. Write a short note on Initial and Final conditions of circuit elements under switching conditions. **(06 Marks)**

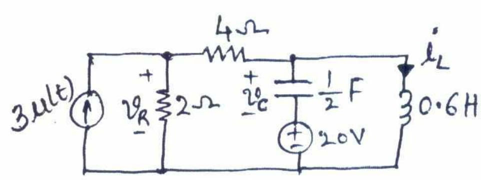
b. In the circuit shown in fig.Q6(b), the switch S_1 has been open for a long time before closing at t = 0. Find $V_c(0^+)$, $i_L(0^+)$, $Vc(\infty)$, $i_L(\infty)$, $\frac{di_L}{dt}(0^+)$ and $\frac{d^2i_L}{dt^2}(0^+)$. **(06 Marks)**

Fig.Q6(b)



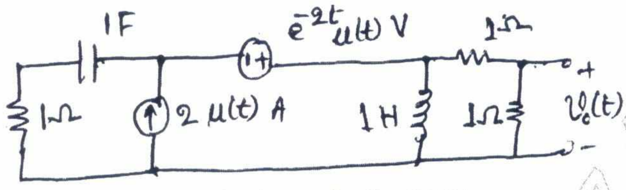
c. For the circuit shown in fig.Q6(c), calculate $i_L(0^+)$ $\frac{di_L(0^+)}{dt}$, $\frac{d}{dt}V_c(0^+)$, $V_R(\infty)$, $V_c(\infty)$ and $i_L(\infty)$ **(08 Marks)**

Fig.Q6(c)



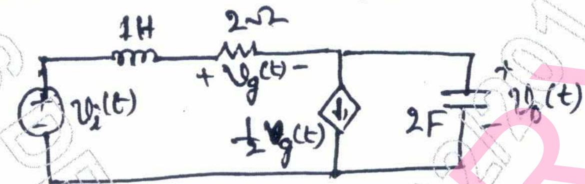
7 a. Find $V_o(t)$ of the circuit shown in fig.Q7(a). **(10 Marks)**

Fig.Q7(a)



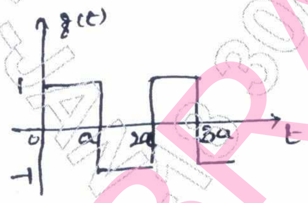
b. Find the impulse response of the circuit shown in fig.Q7(b). **(06 Marks)**

Fig.Q7(b)



c. Find the Laplace Transform of non – sinusoidal periodic waveform shown in fig.Q7(c). **(04 Marks)**

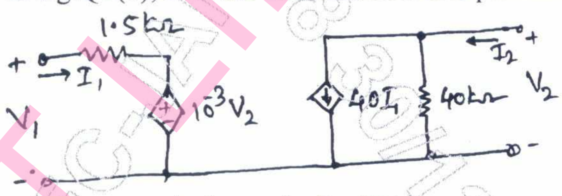
Fig.Q7(c)



8 a. Find the Z – transform in terms of Y - parameters. **(04 Marks)**

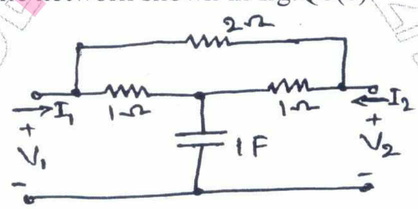
b. For the network shown in fig.Q8(b), find the transmission line parameters. **(08 Marks)**

Fig.Q8(b)



c. Find the h – parameters of the network shown in fig.Q8(c). **(08 Marks)**

Fig.Q8(c)



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10IT35

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. The expected value of the voltage across a resistor is 80V. But, the measurement gives a value of 79V. Calculate
(i) Absolute Error (ii) % Error (iii) Relative Accuracy (iv) % of Accuracy. **(05 Marks)**

b. Fig.Q1(b) shows a series circuit of R_1 and R_2 connected to a 100 V dc source. If the voltage across R_2 is to be measured by voltmeters having
(i) a sensitivity of 1 kΩ/V and (ii) a sensitivity of 20 kΩ/V
Find which voltmeter will read the accurate value of voltage across R_2, if both the voltmeters are used on the 50 V range. **(10 Marks)**

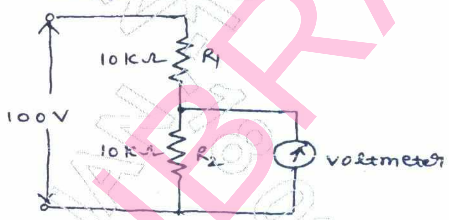

Fig.Q1(b)

c. Draw the circuit diagram of dc coupled peak voltmeter and illustrate the working principle. Mention the limitations of peak responding voltmeter. **(05 Marks)**

2 a. Discuss about the principle of operation of integrating type DVM with the help of block diagram and associated waveforms. **(08 Marks)**

b. With the help of block diagram, explain how a time base with a range of 1 μs – 1 sec can be generated using fixed frequency crystal oscillator. **(05 Marks)**

c. Define the resolution and sensitivity of digital voltmeter. **(04 Marks)**

d. Mention the advantages and limitations of Ramp type DVM. **(03 Marks)**

3 a. With the help of block diagram, explain the role of vertical amplifier in deciding the sensitivity and bandwidth of oscilloscope. **(08 Marks)**

b. Draw the block diagram of dual beam CRO and illustrate its working principle. **(07 Marks)**

c. Discuss the need for delay line in the vertical section of an oscilloscope. **(05 Marks)**

4 a. Explain the working principle of sampling oscilloscope with a neat block diagram and associated waveforms. **(10 Marks)**

b. With a neat block diagram and associated waveforms explain the working principle of digital storage oscilloscope. **(10 Marks)**

PART – B

5 a. Draw the block diagram of modern laboratory signal generator and explain the function of its constituent blocks. **(10 Marks)**
b. Specify the requirements of a pulse which can be generated using pulse generator. **(03 Marks)**
c. With a neat block diagram explain how output frequency can be automatically varied over predetermined range using sweep frequency generator. **(07 Marks)**

6 a. Obtain the Thevenin's equivalent circuit of a slightly unbalanced Wheatstone's bridge. Calculate the current through the galvanometer connected between bridge output terminals if the resistance of 3 arms of the bridge is 700 Ω each and the resistance of 4^{th} arm of the bridge is 735 Ω. **(10 Marks)**
b. Derive the expression for unknown capacitance and its leakage resistance in a capacitance comparison bridge. **(07 Marks)**
c. Mention the applications of Maxwell bridge and Wein bridge. **(03 Marks)**

7 a. Discuss about the parameters to be considered for any electrical transducer. **(05 Marks)**
b. What is a strain gauge? Explain the construction and working principle of semiconductor strain gauge. **(06 Marks)**
c. Mention the advantages of thermistor. **(04 Marks)**
d. Explain the working principle of variable reluctance type transducer. **(05 Marks)**

8 a. Explain the following with respect to thermocouple:
(i) Seebeck effect
(ii) Thomson effect
(iii) Thermocouple types **(07 Marks)**
b. Mention the classification of display devices. **(05 Marks)**
c. With a neat sketch explain how RF power can be measured using Bolometer bridge. **(08 Marks)**

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10ES36

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Field Theory

Time: 3 hrs. Max. Marks:100

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

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 – A

1 a. State and prove gauss law for electrostatics. **(06 Marks)**

b. If $E = (-8xy\hat{a}_x - 4x^2\hat{a}_y + \hat{a}_z)$ V/mt. Find the work done in carrying a 6 C charge from A(1, 8, 5) to B(2, 18, 6) along the path $y = 3x + 2$, $z = x + 4$ **(06 Marks)**

c. Four point charges each 20 μc are at A(4, 0, 0), B(–4, 0, 0), C(0, 4, 0), D(0, - 4, 0) respectively. Find the force on a 200 μC point charge at (0, 0, 3). **(08 Marks)**

2 a. Derive an equation for divergence of flux density in differential form, and hence explain Gauss divergence theorem. **(08 Marks)**

b. A 15 nC point charge is at the origin in free space. Calculate v_1 if point P is located at (2, -3, -1). Also calculate v_1 at P if v = 0 at (6, 5, 4) **(06 Marks)**

c. Deduce an expression for energy and energy density in an electro static field. **(06 Marks)**

3 a. Using Poisson's equation, obtain the expression for junction potential in a p-n junction. **(08 Marks)**

b. Derive Laplace's equation and hence write the expression for Laplacian of V in cylindrical and spherical co-ordinates. **(06 Marks)**

c. Find E at P(3, 1, 2) for the field of two co-axial conducting cylinders. V = 50 V at r = 2 m, V = 20 V at r = 3 m. **(06 Marks)**

4 a. Derive an expression for magnetic flux density ($\vec{B}$) due to straight conductor of finite length. **(06 Marks)**

b. If $\vec{H}$ in a region is $2x\hat{a}_y + (3y-2)\hat{a}_z$, find the current density at the origin. **(06 Marks)**

c. Given the magnetic field $\vec{H} = 2r^2(z+1)\sin\phi\hat{a}_\phi$, verify Stoke's theorem for the portion of cylindrical surface defined by $r = 2$, $\frac{\pi}{4} < \phi < \frac{\pi}{2}$, $1 < z < 1.5$. **(08 Marks)**

PART – B

5 a. Find the magnetic flux density due to long current carrying conductor using vector magnetic potential. **(08 Marks)**

b. Derive the expression for boundary conditions, if the field lines are tangent and normal to the boundary line between two media's in static magnetic field. **(06 Marks)**

c. A solenoid with air core has 2000 turns and a length of 500 mm, core radius 40 mm. Find its inductance. **(06 Marks)**

6 a. Derive the modification of Ampere's circuit law to suit for time varying conditions. **(06 Marks)**

b. Explain Maxwell's equations in point and integral form. Establish relationship between conduction current density and displacement current density for the given field $E = E_0 \sin \omega t$ **(08 Marks)**

c. Do the fields $E = E_m \sin x \sin t \hat{a}_y$ and $\vec{H} = \frac{E_m}{\mu} \cos x \cos t \hat{a}_z$. Satisfy Maxwell's equations. Verify. **(06 Marks)**

7 a. Derive an expression for electric and magnetic wave equations. **(06 Marks)**

b. For an electromagnetic wave propagating in free space, show that $\frac{E}{H} = \eta$. **(08 Marks)**

c. Find skin depth and surface resistance of copper conductor at 100 MHz having conductivity $\sigma = 5.8 \times 10^7$ ℧/m and $\mu_r = 100$. **(06 Marks)**

8 a. Explain the reflection of uniform plane wave with normal incidence at a plane dielectric boundary. **(10 Marks)**

b. Write short notes on:
   (i) Reflection co-efficient.
   (ii) Standing wave ratio. **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018

Advanced Mathematics - I

Time: 3 hrs. Max. Marks:100

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

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 – A

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

b. Express the complex number $2 + 3i + \frac{1}{1-i}$ in the form a + ib. **(07 Marks)**

c. Simplify $\frac{(\cos 3\theta + i\sin 3\theta)^4(\cos 4\theta - i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3(\cos 5\theta + i\sin 5\theta)^{-4}}$. **(07 Marks)**

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

b. Find the n^{th} derivative of $\frac{x^2}{2x^2+7x+6}$. **(07 Marks)**

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

3 a. If ϕ is the angle between the tangent and radius vector to the curve $r = f(\theta)$ at any point (r, θ), prove that $\tan\theta = \frac{rd\theta}{dr}$. **(06 Marks)**

b. Find the angle of intersection between the curves $r^n = a^n\cos n\theta$ and $r^n = b^n \sin n\theta$. **(07 Marks)**

c. Using Maclaurin's series, expand tan x up to the term containing x^5. **(07 Marks)**

4 a. If $Z = f(x+ct) + \phi(x-ct)$, prove that $\frac{\partial^2 z}{\partial t^2} = C^2\frac{\partial^2 z}{\partial x^2}$. **(06 Marks)**

b. If $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$ prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ tan u. **(07 Marks)**

c. 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)**

PART – B

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

b. Using reduction formula evaluate $\int_0^a \frac{x^7}{\sqrt{a^2-x^2}}dx$. **(07 Marks)**

c. Evaluate $\int_0^1\int_0^1 e^{x+y}\,dx\,dy$. **(07 Marks)**

6 a. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2yz \, dxdydz$. **(07 Marks)**

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

c. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. **(06 Marks)**

7 a. Solve $3e^x \tan y \, dx + (1-e^x) \sec^2 y dy = 0$. **(06 Marks)**

b. Solve $(2x + 3y + 4)dx - (4x + 6y + 5) dy = 0$. **(07 Marks)**

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

8 a. Solve $\dfrac{d^2y}{dx^2} + 4\dfrac{dy}{dx} + 5y = -2 \cosh x$. **(06 Marks)**

b. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$. **(07 Marks)**

c. Solve $\dfrac{d^2y}{dx^2} + 4y = x^2 + \cos 2x$. **(07 Marks)**

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