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10MAT31

Third Semester B.E. Degree Examination, June/July 2018
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. Obtain the Fourier Series for the function,
$$f(x)=\begin{cases}\pi x & \text{in } 0\le x\le 1\\ \pi(2-x) & \text{in } 1\le x\le 2\end{cases}.$$ **(07 Marks)**

b. Find the cosine half range series for $f(x)=x(l-x)$; $0\le x\le l$. **(06 Marks)**

c. Obtain the Fourier series of y upto the second harmonics for the following values: **(07 Marks)**

x^0	45	90	135	180	225	270	315	360
y	4.0	3.8	2.4	2.0	-1.5	0	2.8	3.4

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

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

c. Find the Fourier cosine transform of e^{-ax} and deduce that
$$\int_0^\infty \frac{\cos mx}{a^2+x^2}dx=\frac{\pi}{2a}e^{-am}.$$ **(07 Marks)**

3 a. Obtain the various possible solution of one-dimensional wave equation $u_{tt}=C^2u_{xx}$ by the method of separation of variables. **(07 Marks)**

b. A tightly stretched string with fixed end points x = 0 and x = l is initially at rest in its equilibrium position. If each of its points is given a velocity $\lambda x(l-x)$. Find the displacement of the string at any distance x from one end at any time t. **(06 Marks)**

c. Solve the Laplace equation, $\dfrac{\partial^2u}{\partial x^2}+\dfrac{\partial^2u}{\partial y^2}=0$

subject to the conditions $u(0, y) = u(l, y) = u(x, 0) = 0$ and $u(x, a) = \sin\dfrac{n\pi x}{l}$. **(07 Marks)**

4 a. Predict the mean radiation dose at an altitude of 3000 feet by fitting an exponential curve to the given data using $y=ab^x$ **(07 Marks)**

Altitude (x) :	50	450	780	1200	4400	4800	5300
Dose of radiation (y) :	28	30	32	36	51	58	69

b. Using graphical method solve the LPP,

Maximize $z=50x_1+60x_2$,

Subject to the constraints : $2x_1+3x_2\le 1500$,

$3x_1+2x_2\le 1500$,

$0\le x_1\le 400$,

$0\le x_2\le 400$,

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

c. Solve the following minimization problem by simplex method:
Objective function : $P = -3x + 8y - 5z$
Constraints : $-x - 2z \le 5$,
$2x - 3y + z \le 3$,
$2x - 5y + 6z \le 5$,
$x_1, x_2, x_3 \ge 0$. **(07 Marks)**

PART – B

5 a. Using Newton-Raphson iterative formula find the real root of the equation $x \log_{10} x = 1.2$. Correct to five decimal places. **(07 Marks)**

b. Solve, by the relaxation method, the following system of equations:
$9x - 2y + z = 50$
$x + 5y - 3z = 18$
$-2x + 2y + 7z = 19$. **(06 Marks)**

c. Using the Rayleigh's power method find the dominant eigen value and the corresponding eigen vector of the matrix, $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ taking $[1, 1, 1]^T$ as the initial eigen vector. Peform five iterations. **(07 Marks)**

6 a. The population of a town is given by the table. Using Newton's forward and backward interpolation formulae, calculate the increase in the population from the year 1955 to 1985. **(07 Marks)**

Year	1951	1961	1971	1981	1991
Population in thousands	19.96	39.65	58.81	77.21	94.61

b. The observed values of a function are respectively 168, 120, 72 and 63 at the four positions 3, 7, 9, 10 of the independent variable. What is the best estimate you can give for the value of the function at the position 6 of the independent variable? Use Lagrange's method. **(06 Marks)**

c. Use Simpson's $\left(\frac{3}{8}\right)^{th}$ Rule to obtain the approximate value of $\int_0^{0.3} \left(1 - 8x^3\right)^{\frac{1}{2}} dx$ by considering 3 equal intervals. **(07 Marks)**

7 a. Solve numerically the wave equation $u_{xx} = 0.0625 u_{tt}$ subject to the conditions, $u(0, t) = 0 = u(5, t)$, $u(x, 0) = x^2(x - 5)$ and $u_t(x, 0) = 0$ by taking $h = 1$ for $0 \le t \le 1$. **(07 Marks)**

b. Solve : $u_{xx} = 32 u_t$ subject to the conditions, $u(0, t) = 0$, $u(1, t) = t$ and $u(x, 0) = 0$. Find the values of u upto t = 5 by Schmidt's process taking $h = \frac{1}{4}$. Also extract the following values:
(i) $u(0.75, 4)$ (ii) $u(0.5, 5)$ (iii) $u(0.25, 4)$ **(06 Marks)**

c. Solve the Laplace equation $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ in the square region shown in the following Fig. Q7 (c), with the boundary values as indicated in the figure. Carry out two iterations. **(07 Marks)**

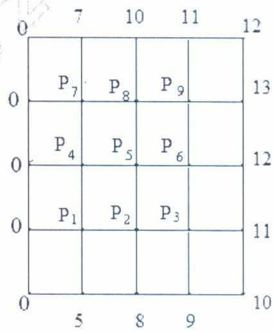

Fig. Q7 (c)

8 a. State initial value property and final value property. If $\bar{u}(z) = \dfrac{2z^2 + 3z + 4}{(z-3)^3}$, $|z| > 3$. Find the values of u_1, u_2, u_3. **(07 Marks)**

b. Obtain the inverse z-transform of the function,

$$\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}.$$ **(06 Marks)**

c. Solve the difference equation, $y_{n+1} + \frac{1}{4} y_n = \left(\frac{1}{4}\right)^n$, $(n \geq 0)$, $y_0 = 0$ by using z-transform method. **(07 Marks)**

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10ES32

Third Semester B.E. Degree Examination, June/July 2018
Analog Electronics Circuits

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Assuming an ideal diode, sketch v_i, v_d and i_d for half-wave rectifier of Fig.1(a). The input is a sinusoid with frequency 50 Hz. **(08 Marks)**

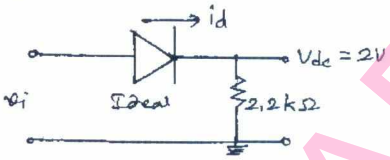

Fig.Q1(a)

b. Determine v_0 for the network shown in Fig.Q1(b). **(06 Marks)**

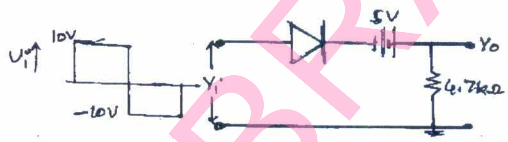

Fig.Q1(b)

c. Sketch v_0 for the network shown in Fig.Q1(c). **(06 Marks)**

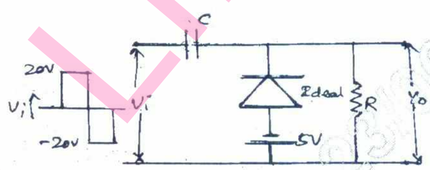

Fig.Q1(c)

2 a. Using exact analysis, obtain the Q-point values for the voltage-divider bias circuit. **(08 Marks)**

b. Obtain the expression for $S(I_{co})$ for an emitter-bias circuit and determine its value for the circuit with $R_B = 470\ k\Omega$, $R_E = 2.2k\Omega$, $R_C = 3.3k\Omega$, $V_{CC} = 12V$ and $\beta = 100$. **(06 Marks)**

c. For the circuit shown in Fig.Q2(c), determine the values for R_1 and R_C. **(06 Marks)**

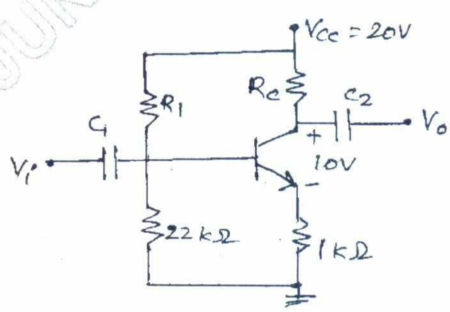

Fig.Q2(c)

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.

3 a. Derive the equations for Z_i, Z_0 and A_V for fully by passed common emitter RC–coupled amplifier. **(08 Marks)**

b. Compare Z_i, Z_0 and A_V of a RC coupled amplifier with emitter follower and explain why emitter follower is called as impedance matching network. **(06 Marks)**

c. For the circuit shown in Fig.Q3(c), find Z_i, Z_0 and A_V. **(06 Marks)**

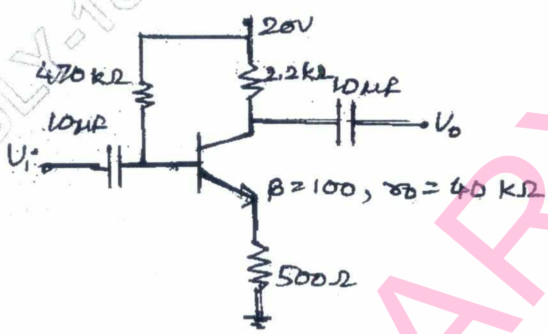

Fig.Q3(c)

4 a. Draw the frequency of RC coupled amplifier and explain high-pass action at low frequencies and low-pass action at high frequencies with relevant equations and Bode plots. **(08 Marks)**

b. Draw the high frequency equivalent circuit for RC coupled amplifier and obtain expressions for f_{Hi} and f_{H0}. **(06 Marks)**

c. Determine f_{C_S} and f_{C_C} for circuit with,

C_S = 10μF, C_E = 20 μF, C_C = 1 μF, R_S = 1kΩ, R_1 = 40kΩ, R_2 = 10 kΩ, R_E = 2kΩ, R_C = 4kΩ, R_L = 2.2kΩ, β = 100, $r_0 = \infty$, V_{CC} = 20V. **(06 Marks)**

PART – B

5 a. Explain the advantages of employing negative feedback in an amplifier. **(06 Marks)**

b. Derive an equation for Z_i and A_V for a Darlington emitter follower. **(08 Marks)**

c. For cascaded stages shown in Fig.Q5(c), determine :

i) Loaded gain for each stage

ii) Total gain for the system A_V and A_{VS}. **(06 Marks)**

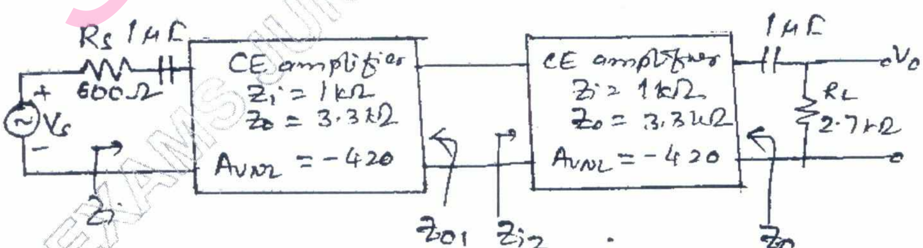

Fig.Q5(c)

6 a. Derive the expression for maximum percentage efficiency for a seriesfed class–A power amplifier. **(08 Marks)**

b. Calculate the second harmonic distortion for an output waveform with $V_{CE_Q} = 10V$, $V_{CE_{min}} = 1V$, $V_{CE_{max}} = 18V$. **(06 Marks)**

c. Draw the circuit of a class-B push-pull amplifier and explain the working. Explain why cross-over distortion occurs in class-B and how it is overcome. **(06 Marks)**

7 a. With a neat circuit diagram, explain the principle of operation of RC phase-shift oscillator with necessary equations. **(08 Marks)**

b. Explain the working of transistor crystal oscillator in series resonant mode. **(06 Marks)**

c. Design a Weinbridge oscillator for a frequency of 4KHz. **(06 Marks)**

8 a. Derive equations for Z_i, Z_0 and A_V for JFET fixed bias configuration, with source resistor bypassed. **(08 Marks)**

b. For JFET amplifier shown in Fig.Q8(b), find Z_i, Z_0 and A_V. **(08 Marks)**

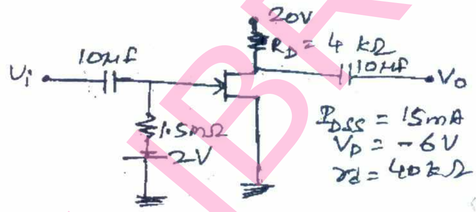

Fig.Q8(b)

c. Explain the graphical determination of g_m. **(04 Marks)**

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10ES33

Third Semester B.E. Degree Examination, June/July 2018
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Reduce the following function using K-Map technique and implement using gates :
$J = f(A, B, C, D, E) = \Sigma_m(4, 5, 6, 7, 9, 11, 13, 15, 25, 27, 29, 31)$
$G = f(A, B, C, D) = \pi M(0, 4, 5, 7, 8, 9, 11, 12, 13, 15)$. **(12 Marks)**

b. Fig.Q1(b) shows a BCD counter that produces a 4-bit output representing the BCD code for the number of pulses that have been applied to the counter input. The counter resets to "0000" on the tenth pulse and starts recounting. Design the logic circuit that produces a "High" output whenever the count is 2, 3, or 9. Use K–Mapping and implement the logic circuit using NAND gates. **(08 Marks)**

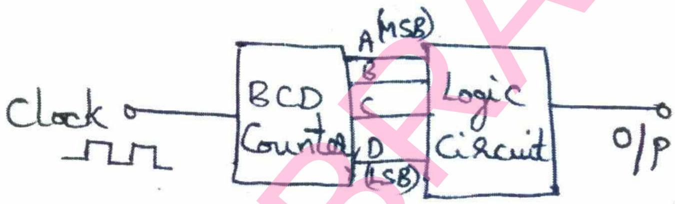

Fig.Q1(b)

2 a. Convert the given Boolean function $f(x,y,z) = [x + \bar{x}\,\bar{z}(y + \bar{z})]$ into maxterm canonical form and hence highlight the importance of canonical formula. **(06 Marks)**

b. Simplify using Quine Mc Cluskey tabulation algorithm.
$v = f(a,b,c,d) = \sum(2,3,4,5,13,15) + \sum d(8,9,10,11)$. **(14 Marks)**

3 a. Implement a full subtractor using decoder and write the truth table. **(10 Marks)**

b. What are the problems associated with the basic encoder? Explain how they can be overcone by priority encoder, considering 8 input lines. **(10 Marks)**

4 a. Design a combinational circuit that accepts two unsigned, 2-bit binary number $A = A_1 A_0$ and $B = B_1 B_0$ and provide 3 outputs corresponding to $A = B$, $A > B$ and $A < B$. **(08 Marks)**

b. Implement $f(a, b, c, d) = \Sigma m(0, 1, 5, 6, 7, 9, 10, 15)$ using :
i) 8 : 1 MUX with a, b, c as select line
ii) 4 : 1 MUX with a, b as select lines. **(08 Marks)**

c. Explain the terms :
i) Ripple–carry propagation
ii) Look–ahead carry. **(04 Marks)**

PART – B

5 a. What is a flip-flop? Discuss the working principle of S-R flip-flop with its truth table. Also explain the role of S-R latch in switch debouncer circuit. **(08 Marks)**

b. With neat schematic diagram of master slave JK-FF, discuss its operation. Mention the advantages of JK-FF over master slave SR-FF. **(12 Marks)**

6 a. Design a 4-bit universal shift register using positive edge triggered D-flip-flops to operate as shown in table below TableQ6(a). **(12 Marks)**

Select line		Data line selected	Register Operation
S_1	S_0		
0	0	I_0	Hold
0	1	I_1	Shift right
1	0	I_2	Shift left
1	1	I_3	Parallel load

Table Q6(a)

b. Explain the working of a 4-bit asynchronous DeCade counter using JKFF in toggel mode. **(08 Marks)**

7 a. Explain mealy and Moore sequential circuit models. **(04 Marks)**

b. For the state machine M_1 shown in Fig.Q7(b) obtain,

i) State table
ii) Transition table
iii) Excitation table for T flip-flop
iv) Logic circuit for T excitation realization. **(16 Marks)**

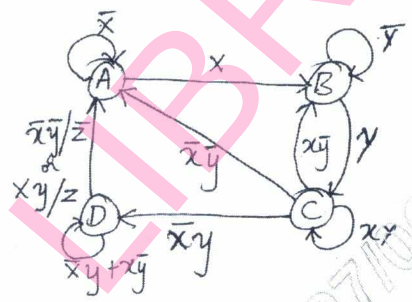

Fig.Q7(b)

8 a. Construct Moore and Mealy state diagram that will detect input sequence 10110, when input pattern is detected Z is asserted high. Give state algorithms for each state. **(10 Marks)**

b. Design a cyclic Mod6, synchronous binary counter using J-K flip-flop. Give the state diagram, transition table and excitation table. **(10 Marks)**

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

Time: 3 hrs. Max. Marks:100

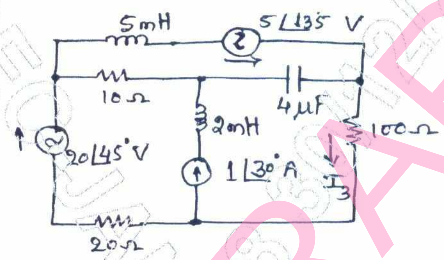
Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

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

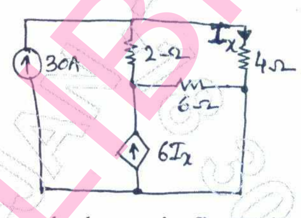
b. Find the current I_3 using mesh analysis for the circuit shown in fig.Q1(b), if the circuit is operating at frequency 5000 rad/s. **(07 Marks)**

Fig.Q1(b)



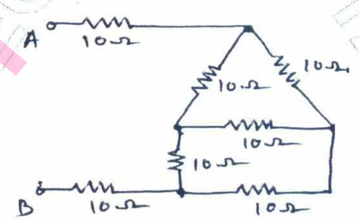
c. For the circuit shown in fig. Q1(c), find the power delivered by dependent source using node analysis. **(06 Marks)**

Fig.Q1(c)



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

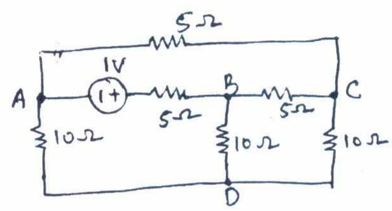
Fig.Q1(d)



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

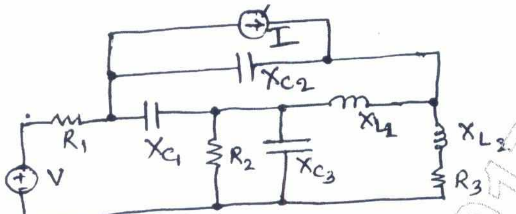
b. For the circuit in fig.Q2(b), write the tie – set matrix using AB, BC and CA or the links of the tree. Obtain the equilibrium equations in matrix from using KVL and calculate all loop currents and branch voltages. **(10 Marks)**

Fig.Q2(b)



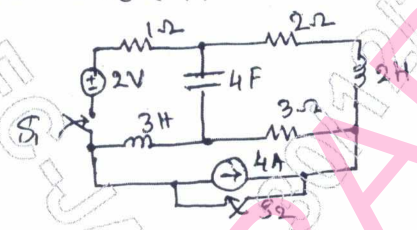
c. Draw the oriented graph for the circuit shown in fig.Q2(c). Also find fundamental cut – set schedule using X_{c1} , R_2 and X_{L1} or the twigs of the tree. Find admittance matrix also. **(04 Marks)**

Fig.Q2(c)



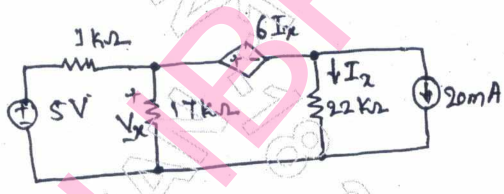
d. Find the dual of the circuit shown in fig.Q2(d). **(03 Marks)**

Fig.Q2(d)



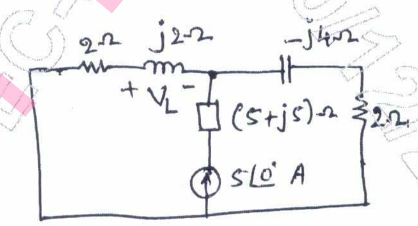
3 a. Find V_x using superposition for the circuit shown in fig.Q3(a). **(08 Marks)**

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)**

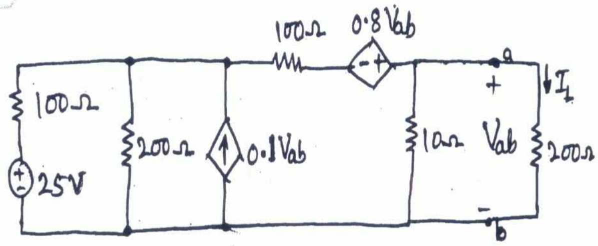
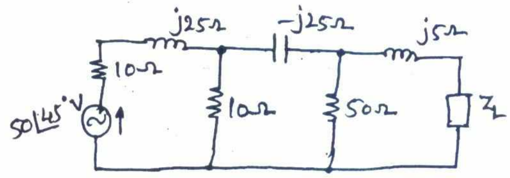


Fig.Q4(a)

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)**

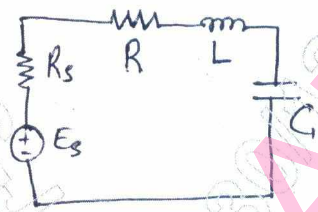
Fig.Q4(c)



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)**

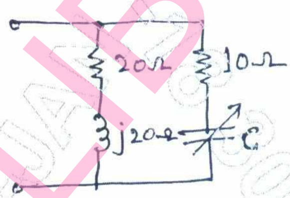
Fig.Q5(a)



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)**

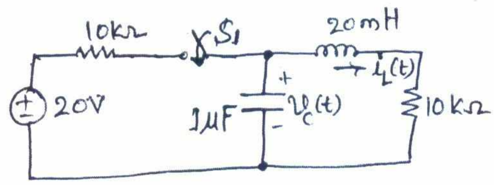
Fig.Q5(c)



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

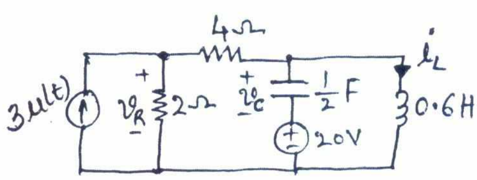
b. In the circuit shown in fig.Q6(b), the switch S_1 has been open for a long time before closing at t = 0. Find $V_c(0^+)$, $i_L(0^+)$, $V_c(\infty)$, $i_L(\infty)$, $\frac{di_L}{dt}(0^+)$ and $\frac{d^2 i_L}{dt^2}(0^+)$. **(06 Marks)**

Fig.Q6(b)



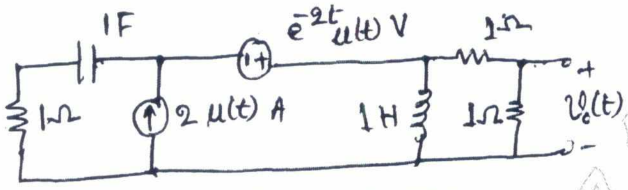
c. For the circuit shown in fig.Q6(c), calculate $i_L(0^+)$ $\frac{di_L(0^+)}{dt}$, $\frac{d}{dt}V_c(0^+)$, $V_R(\infty)$, $V_c(\infty)$ and $i_L(\infty)$ **(08 Marks)**

Fig.Q6(c)



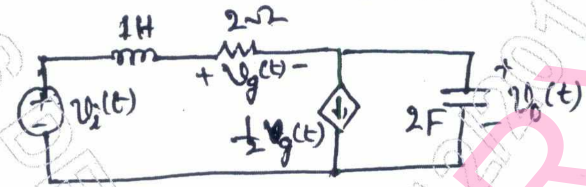
7 a. Find $V_o(t)$ of the circuit shown in fig.Q7(a). **(10 Marks)**

Fig.Q7(a)



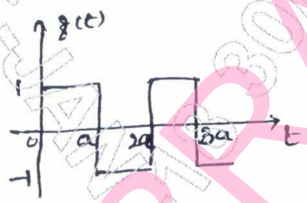
b. Find the impulse response of the circuit shown in fig.Q7(b). **(06 Marks)**

Fig.Q7(b)



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

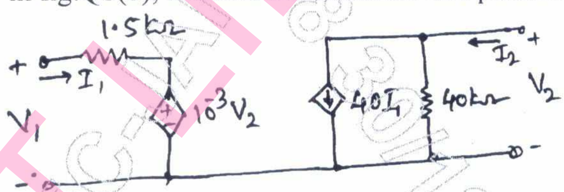
Fig.Q7(c)



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

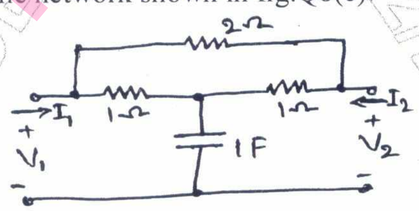
b. For the network shown in fig.Q8(b), find the transmission line parameters. **(08 Marks)**

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, June/July 2018
Electronic Instrumentation

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. Define the following terms as applied to an electronic instrument:
(i) Accuracy (ii) Precision (iii) Resolution. **(06 Marks)**

b. Explain the working of a true RMS voltmeter with the help of a suitable block diagram. **(07 Marks)**

c. Find the voltage reading and % error of each reading obtained with a voltmeter on, (i) 5 V range (ii) 10 V range, If the instrument has a 20 KΩ/V sensitivity and is connected across R_b. Comment upon the results.[Refer Fig. Q1 (c)] **(07 Marks)**

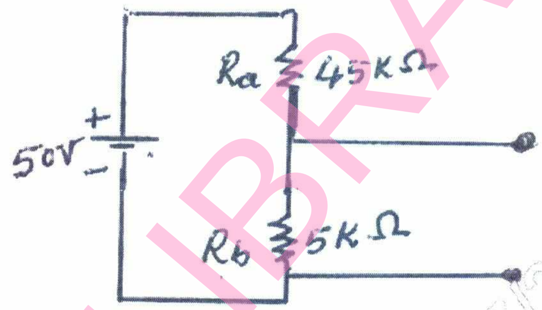

Fig. Q1 (c)

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

b. Discuss the operation of dual slope integration type DVM with the help of block diagram (V-T). **(08 Marks)**

c. Determine the resolution of a $3\frac{1}{2}$ digit display on 1 V and 10 V ranges. **(04 Marks)**

3 a. Draw the basic block diagram of CRO, explain the functions of each block. **(10 Marks)**

b. Explain the C.R.T features briefly. **(04 Marks)**

c. Discuss the operation of an Electronic switch in oscilloscope. **(06 Marks)**

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

b. Write an explanatory note on sampling oscilloscopes. **(10 Marks)**

PART – B

5 a. Explain the operating principle of a function generator with the help of a block diagram. **(08 Marks)**

b. Explain the operation of a conventional standard signal generator with the help of a block diagram. Mention the applications. **(08 Marks)**

c. Differentiate between pulse and square waves. Also mention their applications. **(04 Marks)**

6 a. What are the limitations of Wheat Stone's bridge? Derive the balance equation of Kelvin's bridge. (05 Marks)

b. Derive the equation to measure an inductive impedance of a Maxwell's bridge. Also find the series equivalent of the unknown impedance if the bridge constants at balance are $C_1 = 0.01\ \mu F$, $R_1 = 470\ K\Omega$, $R_2 = 5.1\ K\Omega$ and $R_3 = 100\ K\Omega$ (07 Marks)

c. Explain the operating of the Wien's bridge with a neat circuit diagram. Derive the expression for the frequency. (08 Marks)

7 a. Distinguish between active and passive transducers with an example. (04 Marks)

b. Explain the construction, principle and operation of LVDT, show characteristic curves. How is the direction of motion determined and list any three advantages. (12 Marks)

c. A platinum temperature transducer has a resistance of 100 Ω at 25°C,

(i) Find its resistance at 75°C if the platinum has a temperature co-efficient of 0.00392/°C.

(ii) If the platinum temperature transducer has a resistance of 200 Ω.

Calculate the temperature use linear approximation. (04 Marks)

8 a. What is Bolometer? Explain RF power measurement using bolometer bridge. (07 Marks)

b. Give the classification of digital displays, compare the LED's and LCD's. (06 Marks)

c. A small AF voltage of 15 V is super imposed on the RF test power and balance is achieved. If the RF test power is now turned off, 25 V AF is required to balance the bridge. If the bridge arms has a resistance of 200 Ω. Calculate the RF test power. (04 Marks)

d. A resistance strain gauge with a gauge factor of 4 is cemented to a steel member which is subjected to a strain of 1×10^{-6}. If the original gauge resistance is 150 Ω, calculate the change in resistance. (03 Marks)

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10ES36

Third Semester B.E. Degree Examination, June/July 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 explain Coulomb's law in vector form. **(06 Marks)**

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

c. If a point charge $Q_1 = 25nC$ be located at $A(4,-2,7)$ and a charge $Q_2 = 60nC$ be at $B(-3,4,2)$ in air. Find $\overline{D}$ at $C(1, 2, 3)$. **(08 Marks)**

2 a. Define potential and potential difference and establish the relation $\overline{E} = -\nabla V$. **(06 Marks)**

b. Deduce the relations for boundary conditions between two dielectrics. **(06 Marks)**

c. Let $V = \dfrac{\cos 2\phi}{r}$ in the free space. Find

(i) $\overline{E}$ at $P(2, 30°, 1)$

(ii) ρ_V at $Q\left(\dfrac{1}{2}, 60°, 1\right)$ **(08 Marks)**

3 a. Derive an expression for Poisson's and Laplace's equation in an electrostatic field. **(04 Marks)**

b. Derive the following for a concentric spheres filled with dielectric using Laplace's equation,

(i) Potential (V) (ii) Electric field intensity ($\overline{E}$) (iii) Charge density (ρ_s)

(iv) Capacitance (C). **(08 Marks)**

c. Determine whether or not the potential equations, satisfies Laplace equation,

(i) $V = 2x^2 - 4y^2 + z^2$ (ii) $V = r\cos\phi + z$ (iii) $V = r^2 \cos\phi + \theta$ **(08 Marks)**

4 a. Explain Biot Savart law for a magnetic field. **(04 Marks)**

b. State and prove Ampere's circuital law. By using it derive an expression for $\overline{H}$ due to infinite long straight conductor. **(08 Marks)**

c. Find the magnetic field intensity at point 'P' for the circuit shown in Fig. Q4 (c). **(08 Marks)**

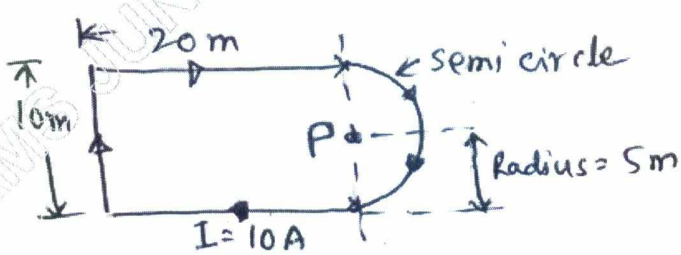

Fig. Q4 (c)

PART – B

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

b. A single turn circular coil 5 cm diameter carries a current of 2.8A. Determine the magnetic flux density $\overline{B}$ at a point on the axis 10 cm from the center. Derive the formula used. **(10 Marks)**

6 a. Write the Maxwell's equations in point form. **(04 Marks)**

b. For a closed stationary path in space linked with a changing magnetic field prove that, $\nabla \overline{E} = -\frac{\partial \overline{B}}{\partial t}$. **(08 Marks)**

c. Determine the value of 'K' such that following pairs of fields satisfies Maxwell's equation in the region where $\sigma = 0$ and $\rho_V = 0$,
$\overline{E} = (Kx - 100t)\overline{a_y}$ V/m and $\overline{H} = (x + 20t)\overline{a_z}$ A/m if $\mu = 0.25$ H/m, $\varepsilon = 0.01$ F/m. **(08 Marks)**

7 a. Derive general wave equations interms of $\overline{E}$ and $\overline{H}$ in uniform medium using Maxwell's equations. **(08 Marks)**

b. A 300 MHz uniform plane wave propogates through (lossless medium) fresh water for which $\sigma = 0$, $\mu_r = 1$ and $\varepsilon_r = 78$. Calculate (i) α (ii) β (iii) λ (iv) η **(08 Marks)**

c. Define (i) Poynting's theorem and (ii) Skin effect. **(04 Marks)**

8 a. Define and explain voltage standing wave ratio (VSWR). **(04 Marks)**

b. Derive an expression for transmission co-efficient and reflection co-efficient at normal incidence of waves at plane dielectric boundary. **(08 Marks)**

c. Find ratio $\left(\frac{E_r}{E_i}\right)$ and $\left(\frac{E_t}{E_i}\right)$ at the boundary for the normal incidence if for the region-1; $\varepsilon_{r_1} = 8.5$, $\mu_{r_1} = 1$ and $\sigma_1 = 0$ and if region-2 is free space. **(08 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June/July 2018
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 modulus and amplitude of : $z = \dfrac{(1+i)^2}{1-i}$. **(06 Marks)**

b. Prove that :
$(1+\cos\theta + i\sin\theta)^n + (1+\cos\theta - i\sin\theta)^n = 2^{n+1}\cos^n\frac{\theta}{2}\cos\frac{n\theta}{2}$. **(07 Marks)**

c. If $x = \cos\theta + i\sin\theta$ and $y = \cos\phi + i\sin\phi$, then prove that $\dfrac{x-y}{x+y} = i\tan\left(\dfrac{\theta-\phi}{2}\right)$. **(07 Marks)**

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

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

c. Expand $\log(1+\sin x)$ in powers of x, by using Maclaurin's theorem. **(07 Marks)**

3 a. If $z = e^{ax+by}f(ax-by)$, then show that $b\dfrac{\partial z}{\partial x} + a\dfrac{\partial z}{\partial y} = 2abz$. **(06 Marks)**

b. If $u = \tan^{-1}\left(\dfrac{x^3+y^3}{x-y}\right)$ then prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \sin 2u$. **(07 Marks)**

c. If $u = \tan^{-1}x + \tan^{-1}y$ and $v = \dfrac{x+y}{1-xy}$ find $\dfrac{\partial(u,v)}{\partial(x,y)}$ **(07 Marks)**

4 a. With usual notation, prove that $\tan\phi = r\dfrac{d\theta}{dr}$. **(06 Marks)**

b. Find the angle between the curves $r = a(1-\cos\theta)$ and $r = 2a\cos\theta$. **(07 Marks)**

c. Find the pedal equation of the curve $r = a(1+\cos\theta)$. **(07 Marks)**

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

b. Evaluate $\displaystyle\int_0^1 \frac{x^9}{\sqrt{1-x^2}}dx$. **(07 Marks)**

c. Evaluate $\displaystyle\int_0^{\log 2}\int_0^{x}\int_0^{x+y} e^{x+y+z}\,dz\,dy\,dx$. **(07 Marks)**

6 a. Prove that $\sqrt{\frac{1}{2}} = \sqrt{\pi}$. **(06 Marks)**

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

c. Evaluate $\int_0^{\infty} \frac{dx}{1+x^4}$ in terms of Beta functions. **(07 Marks)**

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

b. Solve $xdy - ydx = \sqrt{x^2+y^2}\ dx$. **(07 Marks)**

c. Solve $(x^2 - 4xy - 2y^2)\, dx + (y^2 - 4xy - 2x^2)\, dy = 0$. **(07 Marks)**

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

b. Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x} + \cos 2x$. **(07 Marks)**

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

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