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Third Semester B.E. Degree Examination, December 2011
Engineering Mathematics

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 a Fourier series to represent $f(x)=\begin{cases}0 & -\pi\le x\le 0\\ x^2 & 0\le x\le \pi\end{cases}$. **(06 Marks)**

b. Find half range cosine series of $f(x)=1-\dfrac{x}{l}$ in (o, l). **(07 Marks)**

c. Compute the Fourier coefficients a_0, a_1, a_2, b_1 and b_2 for f(x) tabulated below: **(07 Marks)**

x	0	1	2	3	4	5
f(x)	9	18	24	28	26	30

2 a. Find Fourier transform of,

$$f(x)=\frac{1}{2a}\quad |x|\le a$$
$$=0\quad |x|>a$$

(06 Marks)

b. Find Fourier cosine transform of e^{-ax}, $a\ge 0$, hence find $\displaystyle\int_0^\infty \frac{\cos\alpha x}{a^2+\alpha^2}dx$. **(07 Marks)**

c. Find the inverse Fourier sine transform of $\dfrac{1}{s}e^{-as}$. **(07 Marks)**

3 a. Form the second order partial differential equation of $z=xf(ax+by)+g(ax+by)$. **(06 Marks)**

b. Solve : $(y+zx)z_x-(x+yz)z_y=x^2-y^2$. **(07 Marks)**

c. Solve : $3u_x+2u_y=0$, given $u(x,0)=4e^{-x}$ using method of separation of variables. **(07 Marks)**

4 a. With suitable assumptions, derive one dimensional equation for heat flow. **(06 Marks)**

b. Solve : $\dfrac{\partial^2 u}{\partial t^2}=c^2u_{xx}$ by the method of separation of variables. **(07 Marks)**

c. Solve $u_{xx}+u_{yy}=0$, for $0<x<a$, $0<y<b$ and u(x, 0) = 0 ; u(x, b) = 0 ; u(0, y) = 0 ; u(a, y) = f(y). **(07 Marks)**

PART – B

5 a. Find the third approximate root of $xe^x-2=0$, by Regula Falsi method. **(06 Marks)**

b. Using Gauss Seidel method of iteration, find a, b, c (4^{th} iteration values), given $5a-b=9$, $a-5b+c=-4$, $b-5c=6$ taking $\left(\frac{9}{5},\frac{4}{5},\frac{6}{5}\right)$ as first approximation. **(07 Marks)**

c. Find all the eigen values and the eigen vector corresponding to smallest eigen value of :

$$\begin{bmatrix}1 & 0 & -1\\ 1 & 2 & 1\\ 2 & 2 & 3\end{bmatrix}$$

(07 Marks)

6 a. Given the following table of x and f(x), fit a Lagrangian polynomial and hence find f(1) and f(4). **(06 Marks)**

x	-1	0	2	3
f(x)	-8	3	1	2

b. Using Newton's dividend different formula, find f(2, 5) given:

x	-3	-1	0	3	5
f(x)	-30	-22	-12	330	3458

(07 Marks)

c. Tabulate the values y $=\log_e x$, $4 \le x \le 5.2$, in steps of 0.2 and find $\int_4^{5.2} \log_e x \, dx$ using Simpons' $\frac{3}{8}$ rule. **(07 Marks)**

7 a. Derive eulers' equation for extremal value in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(06 Marks)**

b. Determine the plane curve down which a particle will slide down without friction from $A(x_1, y_1)$ to $B(x_2, y_2)$ in shortest time. **(07 Marks)**

c. The curve 'C' joining the two points $A(x_1, y_1)$ to $B(x_2, y_2)$ is rotated about x-axis, find equation of 'C' such that the solid of resolution has minimum surface area. **(07 Marks)**

8 a. Find $z(e^{-an} \sin n\theta)$ and $z(n \cos n\theta)$. **(06 Marks)**

b. Find z^{-1} of $\left\{\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}\right\}$. **(07 Marks)**

c. Solve : $u_{n+2} + 2u_{n+1} + u_n = n$ given $u_0 = u_1 = 0$. **(07 Marks)**

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Third Semester B.E. Degree Examination, December 2011
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Using the Shockley's equation, determine the diode current at 20°C for a Si diode with $I_s = 50$ nA and an applied forward bias voltage of 0.6V. Also, find I_D value if V_D (Forward bias voltage) is halved. **(06 Marks)**

b. Define the following terms: i) Transition and diffusion capacitance ii) Reverse recovery time iii) Diode equivalent circuits. **(08 Marks)**

c. Draw the transfer characteristics of the circuit shown in Fig.Q1(c)(i). Draw the output waveform of the circuit shown in Fig.Q1(c)(ii). Assume ideal diodes. **(06 Marks)**

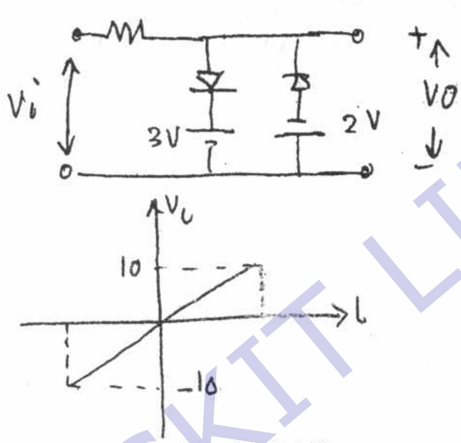


Fig.Q1(c)(i)

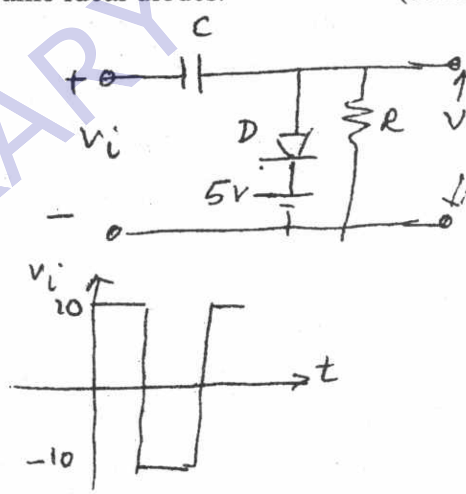


Fig.Q1(c)(ii)

2 a. For the emitter bias circuit, derive an equation for collector current I_{CQ} and collector to emitter voltage V_{CEQ}. Draw the DC load line. **(06 Marks)**

b. Determine the V_C and V_B for the network shown in Fig.Q2(b). **(08 Marks)**

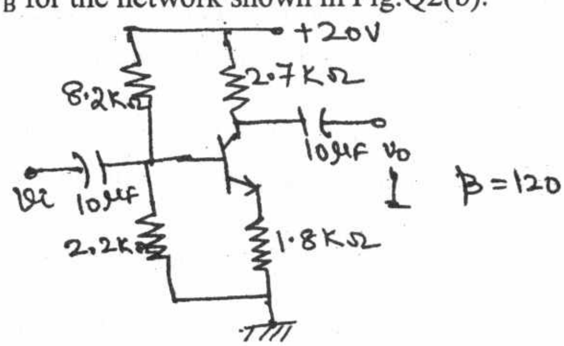
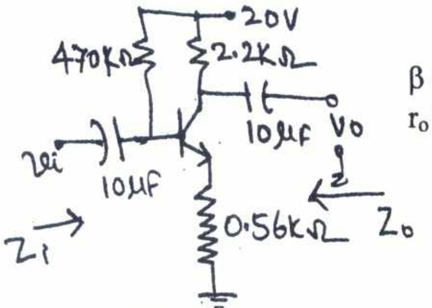


Fig.Q2(b)

c. A transistor amplifier circuit has $S(I_{CO}) = 20$. I_{CO} at 20°C is 50 nA. Determine the collector current, if the temperature increases to 70°C. Assume β and V_{BE} to be constant. Assume I_c at 20°C to be 2 mA. **(06 Marks)**

3 a. Derive an equation for input impedance, output impedance and voltage gain for an emitter follower configuration, with the help of r_e equivalent model. **(08 Marks)**

b. For the network shown in Fig.Q3(b), determine r_e, z_i, z_o and A_v. **(06 Marks)**



$\beta = 120$
$r_o = 40\ k\Omega$

Fig.Q3(b)

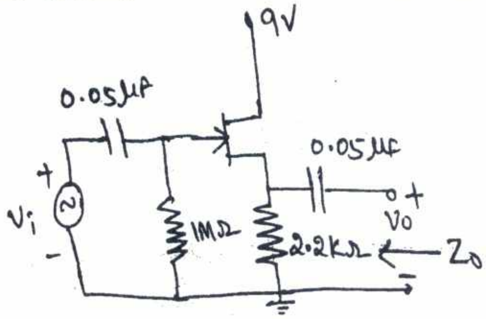


Fig.Q8(b)

c. Explain the effect of R_L and R_S on the equation of gain for a fixed bias configuration. **(06 Marks)**

4 a. An amplifier rated at 40 W output is connected to a 10Ω speaker. Calculate the input power required for full power output, if the power gain is 25 dB. Also, calculate the input voltage for rated output, if the amplifier voltage gain is 40 dB. **(06 Marks)**

b. Explain the low frequency analysis of a single stage BJT amplifier, using the Bode plot. **(08 Marks)**

c. State and explain the Miller effect capacitance. **(06 Marks)**

PART – B

5 a. Derive an equation for dc voltages, dc currents, z_i, z_o and A_i for a Darlington emitter follower. **(10 Marks)**

b. List and explain the advantages of employing negative feedback in amplifiers. **(06 Marks)**

c. Determine the voltage gain, input impedance and output impedance, with feedback for a voltage series feedback having $A = -100$; $R_i = 10k\Omega$; $R_o = 20k\Omega$ for a feedback of $\beta = 0.1$. **(04 Marks)**

6 a. Show that the maximum percentage efficiency for a series fed class A amplifier is 25%. **(06 Marks)**

b. For a class B amplifier having a supply of $V_{cc} = 30V$ and driving a load 16Ω, determine the maximum input power, output power and transistor dissipation. **(06 Marks)**

c. Derive an equation for second harmonic distortion in terms of current. **(08 Marks)**

7 a. State and explain the Barkhausen's criterion to obtain sustained oscillations. **(06 Marks)**

b. With the neat circuit diagram, explain the principle and working of a RC phase shift oscillator, with necessary equations. **(08 Marks)**

c. Design a Wein bridge oscillator for a frequency of 5 kHz. **(06 Marks)**

8 a. Derive z_i, z_o and A_v for a JFET fixed bias configuration using ac equivalent model of the FET. **(08 Marks)**

b. A dc analysis of the source follower results in $V_{GSQ} = -2.86V$ and $I_{DQ} = 4.56$ mA. Determine g_m, r_d, z_i, z_o (with and without r_d), A_v for the network shown in Fig.Q8(b).
Given: $I_{DSS} = 16$ mA, $V_p = -4V$, $Y_{OS} = 30\ \mu s$. **(08 Marks)**

c. With the help of transfer characteristics, explain how trans conductance of an FET can be obtained using graphical method. **(04 Marks)**

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Third Semester B.E. Degree Examination, December 2011
Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Standard notations are used.
3. Missing data be suitably assumed.
4. Draw, diagrams wherever necessary.

PART – A

1 a. Write the steps for converting a verbal problem statement into truth table. **(05 Marks)**

b. A conveyor system brings raw material in from three different sources. The three sources converge into a single output conveyor. Sensors mounted adjacent to each source conveyor indicates the presence of raw material. All four conveyors have separate motors so they can be individually controlled (on/off). It is required to design a on/off control system of motors to meet the following conditions :
If sources has the product, then sources 2 and 3 must be turned off ; if source 1 is empty, then either source 2 or 3 or both can be turned on. In the event that no product is available form the three sources, the output conveyor must be turned off. If no product is available, the respective source conveyor must be turned off i) Determine the number of inputs and outputs ; ii) Construct the truth table that describes the system. **(05 Marks)**

c. Simplify the following Boolean function and realize the simplified expression using NAND gates : $F(v, w, x, y, z) = \sum m\,(3, 7, 8, 10, 11, 12, 14, 15, 17, 19, 21, 23, 25, 27, 29, 31) + \sum d\,(2, 6, 16, 20)$. **(10 Marks)**

2 a. For the Boolean function $f(w, x, y, z) = \sum m\,(0, 1, 3, 7, 8, 12) + \sum d\,(5, 10, 13, 14)$
i) Find the set of prime implicants and ii) Obtain the minimal SOP expressions using QM method. **(12 Marks)**

b. Simplify the Boolean function $f(w, x, y, z) = \sum m$ 1, 2, 3, 6, 7, 10, 14, 15) using MEV K – map with variable z as MEV. **(08 Marks)**

3 a. Write the truth table of IC 74LS147 and draw the set up to interface keypad of decimal digits to the digital system using IC 74LS147. Briefly explain the operation of interface set up. (IC 74LS147 : Decimal – to – BCD priority encoder). **(10 Marks)**

b. Design a combinational circuit using two 74LS138 ICs and NAND gates that generates a logic 1 output when a majority of four inputs are true (logic 1). (IC 74LS138 : 3 – to – 8 decoder). **(10 Marks)**

4 a. Construct the truth table of a full subtractor and realize using IC 74LS153. (IC74LS153 : Dual 4:1 multiplexer). **(06 Marks)**

b. Design a single – digit BCD adder using ICs 7483 having binary – to – BCD conversion logic (IC7483 : 4 – bit parallel adder). **(10 Marks)**

c. Sketch a diagram using two 74LS85ICs to compare (IC74LS85 : 4 – bit magnitude comparator). **(04 Marks)**

PART – B

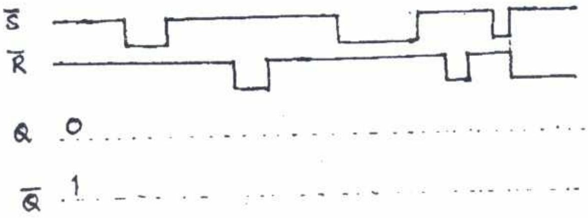
5 a. Explain, how to use SR latch as a switch debouncer. Draw the timing diagram to support your explanation. **(07 Marks)**

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.

b. Draw the logic diagram of master – salve JK flip – flop using gates. Write its function table and derive the characteristic equation. What is the type of triggering used in master – slave flip – flops? **(09 Marks)**

c. In the figure shown in Fig.Q.5(c), complete the timing diagram for a NAND latch. **(04 Marks)**

Fig.Q.5(c)

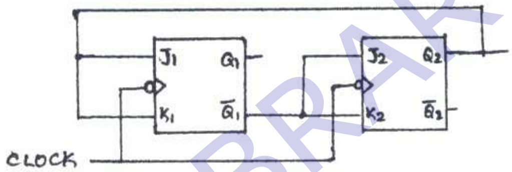


6 a. Draw the logic diagram of a 4-bit universal shift register using 4:1 multiplexers. Write its mode control table. **(06 Marks)**

b. Design a synchronous mod – 6 counter whose counting sequence is 0, 1, 2, 4, 6, 7 and repeat, by obtaining its minimal – sum equations. Use positive – edge – triggered D flip – flops. **(10 Marks)**

c. In the figure shown in Fig.Q.6(c) sketch the counting sequence. Assume both the flip – flops are cleared initially. **(04 Marks)**

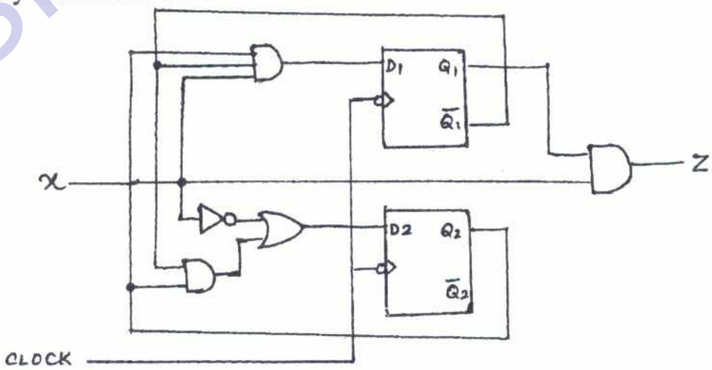
Fig.Q.6(c)



7 a. Describe the following terms with respect to sequential machines :
i) State ; ii) Present state ; iii) Next state. **(06 Marks)**

b. For the logic diagram shown in Fig.Q.7(b) :
- i) Write the excitation and output functions.
- ii) Form the excitation table, transition table, and state table
- iii) Draw the state diagram and
- iv) Is this a mealy machines or Moore machine? **(14 Marks)**

Fig.Q.7(b)



8 a. Construct a state diagram that will detect a serial input sequence of 0101. The required bit pattern can occur in a long data string and the correct pattern can overlap with another pattern. When the input pattern has been detected, cause the output z to be asserted high. Design the sequential machine using D flip – flops. Use the state assignments, $A \rightarrow 00$, $B \rightarrow 01$, $C \rightarrow 10$, $D \rightarrow 11$. **(14 Marks)**

b. Draw the logic diagram of mod-8 twisted - ring counter. Write its counting sequence. **(06 Marks)**

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Third Semester B.E. Degree Examination, December 2011
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. For the network shown in Fig. Q1(a), determine the voltage 'V' using source shift and /or source transformation techniques only. **(06 Marks)**

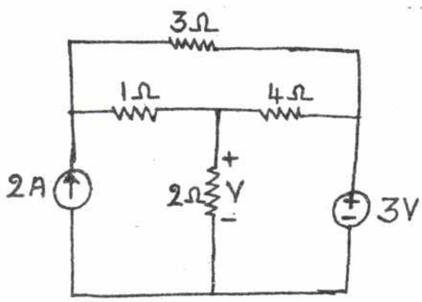

Fig. Q1(a)

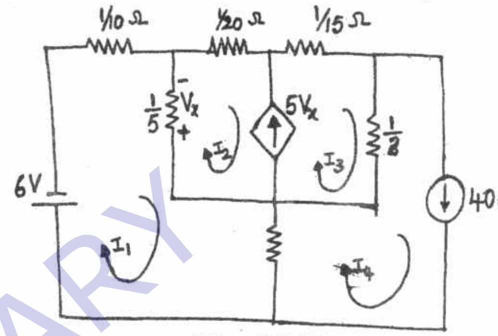

Fig. Q1(b)

b. Find I_1, I_2, I_3 and I_4 using mesh analysis in the network shown in Fig. Q1(b). **(07 Marks)**

c. Find the voltages at nodes 1, 2, 3 for the network shown in Fig. 1(c), using nodal analysis. **(07 Marks)**

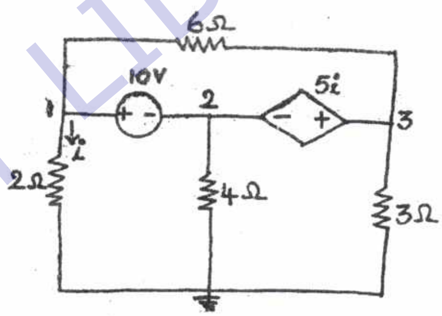

Fig.Q1(c)

2 a. Define with examples :

i) Oriented graph ii) Tree iii) Fundamental cut – set iv) Fundamental tie –set. **(06 Marks)**

b. For the network shown in Fig. Q2(b), write the graph of the network and obtain the tie – set schedule considering J_1, J_2, J_5 as tree branches. Calculate all the branch currents. **(07 Marks)**

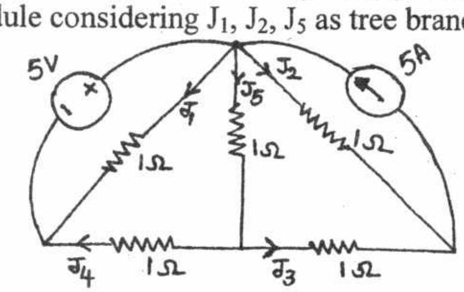

Fig. Q2(b)

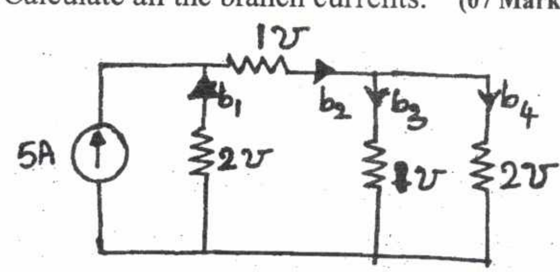

Fig. Q2(c)

c. For the network given in Fig. Q2(c), write the f – cutest matrix considering branches b_1 and b_3 as tree branches and hence, obtain the equilibrium equation on node basis and calculate the node voltages. **(07 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.

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

b. Using the superposition theorem, obtain the response I for the network shown in Fig. 3(b). **(07 Marks)**

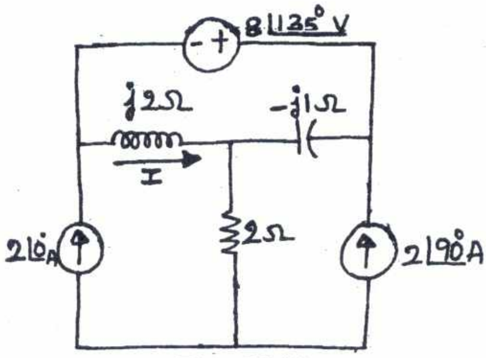

Fig. Q3(b)

c. Find the Thevenin's equivalent circuit across A, B using Millman's theorem and find the current through the load (5 + j5) Ω, shown in Fig. 3(c). **(07 Marks)**

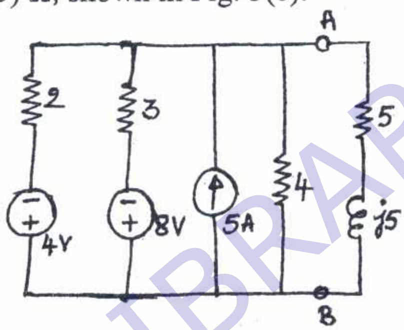

Fig. Q3(c)

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

b. Find the Thevenin's equivalent of the network shown in Fig. Q4(b). **(07 Marks)**

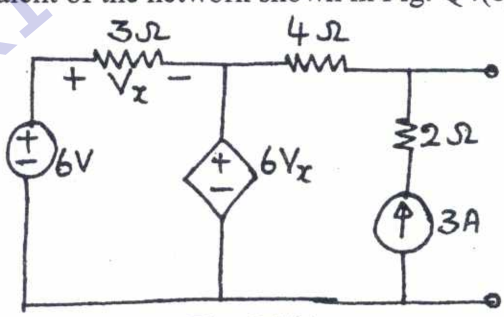

Fig. Q4(b)

c. What will be the value of R_L to get maximum power delivered to it? What is the value of this power? Refer the network shown in Fig. Q4(c). **(07 Marks)**

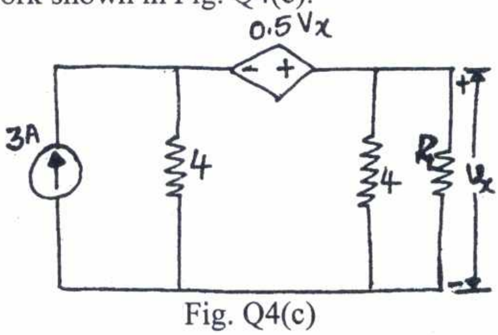

Fig. Q4(c)

PART – B

5 a. A series resonant circuit includes 1μF capacitor and a resistance of 16Ω. If the BW is 500 rad/sec, determine : i) W_r ii) Q iii) L. **(06 Marks)**

b. Derive the expression for parallel resonance circuit, containing resistance in both the branches. Also show that the circuit will resonate at all frequencies if $R_L = R_C = \sqrt{\frac{L}{C}}$. **(10 Marks)**

c. Give the comparison between the series resonance and parallel resonance. **(04 Marks)**

6 a. In the network shown in Fig. Q6(a), the switch is moved from position '1' to position 2 at t = 0, the steady – state having reached before switching. Calculate i, $\frac{di}{dt^2}$, and $\frac{d^2i}{dt^2}$ all at $t = 0^+$. **(10 Marks)**

b. In the network shown in Fig. 6(b), a steady state is reached with the switch K open. At t = 0, the switch K is closed. Obtain the initial values of

i) i ii) i_2 iii) v_c iv) $\frac{di_1}{dt}$ v) $\frac{di_2}{dt}$ and $\frac{di_1}{dt}$ at $t = \infty$. **(10 Marks)**

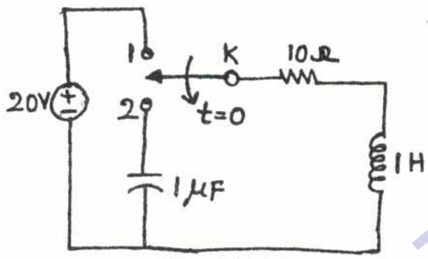

Fig. Q6(a)

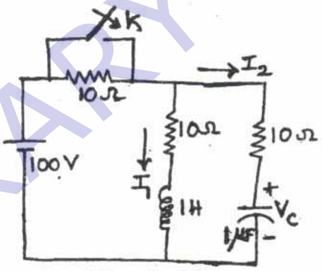

Fig. Q6(b)

7 a. In the circuit of Fig. Q7(a), the source voltage is v(t) = 50 sin 250 t. Using Laplace transforms, determine the current, when switch K is closed at t = 0. **(10 Marks)**

b. In the network shown in Fig. 7(b), the switch K is closed and the steady state is reached. At t = 0, the switch is opened. Find the expression for the current in the inductor using Laplace transform. **(10 Marks)**

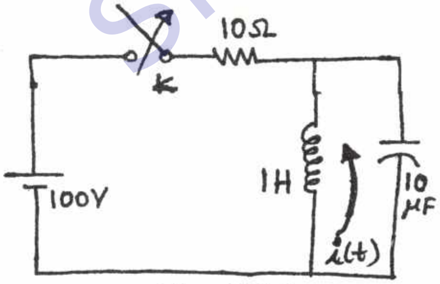

Fig. Q7(a)

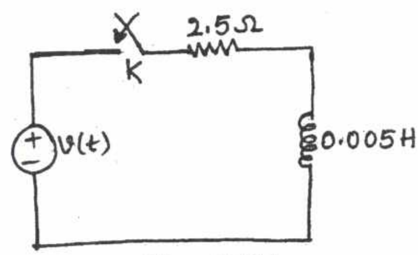

Fig. Q7(b)

8 a. Derive Y – parameters and transmission parameters in terms of Z – parameters. **(10 Marks)**

b. Find the transmission parameters for the given R – C network shown in Fig. 8(b). **(10 Marks)**

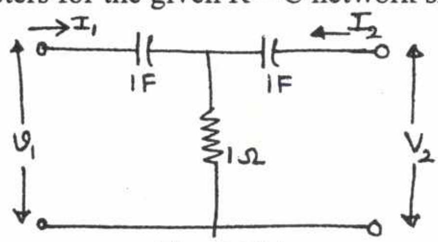

Fig. Q8(b)

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Third Semester B.E. Degree Examination, December 2011
Electronic Instrumentation

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. Define the following : i) Accuracy ; ii) Precision ; iii) Resolution ; iv) Significant figures. **(08 Marks)**

b. A basic D'Arsonval movement with full scale deflection current of 50 μA and 100 Ω is used in a multirange voltmeter. Design the multiplier resistance to convert into 0 – 10V and 0 – 100V range. **(06 Marks)**

c. With block schematic, explain a true rms voltmeter. **(06 Marks)**

2 a. Give the working principle of following : i) V – F type DVM ; ii) Successive approximation DVM. **(12 Marks)**

b. Explain the principle, construction and working of a digital frequency meter. **(08 Marks)**

3 a. With block diagram, explain the working of a single beam CRO. **(10 Marks)**

b. With block diagram, explain the principle and working of a dual beam CRO. **(10 Marks)**

4 a. Give the block schematic of a digital storage oscilloscope and explain them in brief. **(10 Marks)**

b. With block diagram, explain the operation of an analog storage oscilloscope. **(10 Marks)**

PART – B

5 a. Explain the construction and working of
i) AF sine and square wave generator ; ii) Function generator. **(16 Marks)**

b. Give at least four major requirements of a pulse signal generation. **(04 Marks)**

6 a. A wheat stone bridge "abcd" consists of arm ab = 1 kΩ, bc = 2.5 kΩ, cd = 10 kΩ and da = 3.5 kΩ. A 5V supply is connected across b and d. A galvanometer across a and c. Find galvanometer current. **(06 Marks)**

b. Give the circuit diagram of Maxwell's inductance – capacitance bridge and derive necessary equations of balance. **(08 Marks)**

c. An AC bridge "abcd" has the following :
Arm ab : Resistance of 10 kΩ
Arm bc : Resistance of 2 kΩ in series with c = 1 πF
Arm cd : resistance of 1 kΩ
Arm da : unknown.
Bridge is exited by an AC source of 3000 rad/s and it is connected between b and d. If the bridge is in balance, find the series equivalent inductance and resistance of unknown. **(06 Marks)**

7 a. Give five important factors to be considered while selecting a transducer. **(05 Marks)**

b. A resistance strain gauge with gauge factor of 2 is cemented to a steel beam, which is subjected to a 1 μ strain. If the original resistance of gauge is 120 Ω, find the change in resistance. **(03 Marks)**

c. Explain the following temperature transducers : i) Resistance thermometer ; ii) Thermistor. **(12 Marks)**

8 a. Write a short note on phototransistor. **(05 Marks)**

b. Explain the principle and construction of J and K type thermocouples and list their advantages. **(08 Marks)**

c. Explain the bolometric method of RF power measurement. **(07 Marks)**

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Third Semester B.E. Degree Examination, December 2011

Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State vector form of Coulomb's law of force between two point charges and indicate the units of quantities in the force equation. **(06 Marks)**

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

c. A line charge of 2 nc/m lies along y-axis while surface charge densities of 0.1 nc/m^2 and -0.1nc/m^2 exist on the plane z = 3 and z = -4m respectively. Find the $\overline{E}$ at P(1, 7, -2). **(08 Marks)**

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

b. Obtain boundary conditions for perfect dielectric materials in electrostatic field. **(06 Marks)**

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

i) $\overline{E}$ at A(2, 30°, 1)

ii) ρ_v at B(0.5, 60°, 1) **(08 Marks)**

3 a. Derive the expressions for Poisson's and Laplace's equation. **(04 Marks)**

b. By applying Laplace's equation, find the expression for capacitance between the two concentric spheres. Make suitable assumptions. **(08 Marks)**

c. Given the potential field $V = [Ar^4 + Br^{-4}]\sin 4\phi$:

i) Show that $\nabla^2 V = 0$.

ii) Find A and B such that V = 100V and $|\overline{E}|$ = 500 V/m at P(r = 1, ϕ = 22.5°, z = 2). **(08 Marks)**

4 a. State and explain Biot Savart law. **(04 Marks)**

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

c. Find the magnetic flux density at the centre 'o' of a square of sides equal to 5m and carrying 10 amperes of current. **(08 Marks)**

PART – B

5 a. Derive an expression for magnetic force on :

i) Moving point charge and

ii) Differential current element. **(10 Marks)**

b. Two differential current elements, $I_1\Delta\overline{L}_1 = 10^{-5}\,\overline{a}_z$ A.m. at P$_1$(1, 0, 0) and $I_2\Delta\overline{L}_2 = 10^{-5}(0.6\overline{a}_x - 2\overline{a}_y + 3\overline{a}_z)$ A.m. at P$_2$(-1, 0, 0) are located in free space. Find vector force exerted on $I_2\Delta\overline{L}_2$ by $I_1\Delta\overline{L}_1$. **(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 $\nabla \times \overline{E} = -\frac{\partial \overline{B}}{\partial t}$. (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 $\rho_v = 0$.

$$\overline{E} = [Kx - 100t]\,\overline{a}_y \text{ V/m} \qquad \overline{H} = [x + 20t]\,\overline{a}_z \text{ A/m}$$
$$\mu = 0.25 \text{ H/m}, \qquad \varepsilon = 0.01 \text{ F/m}$$
(08 Marks)

7 a. Derive general wave equations in terms of $\overline{D}$ and $\overline{B}$ in uniform medium using Maxwell's equations. (08 Marks)

b. A 300 MHz uniform plane wave propagates through (lossless med.) 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 SWR and write the relation between SWR and transmission coefficient (Γ). (04 Marks)

b. Define transmission and reflection coefficients and derive the expressions for τ and Γ in terms of η. (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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Third Semester B.E. Degree Examination, December 2011

Advanced Mathematics - I

Time: 3 hrs. Max. Marks:100

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

1 a. Express $\dfrac{1}{(2+i)^2} - \dfrac{1}{(2-i)^2}$ in the form $a+ib$. **(06 Marks)**

b. Find the modulus and amplitude of $\dfrac{(3-\sqrt{2}i)^2}{1+2i}$. **(07 Marks)**

c. Find the real part of $\dfrac{1}{1+\cos\theta+i\sin\theta}$. **(07 Marks)**

2 a. Find the n^{th} derivative of $\cos x \cos 2x \cos 3x$. **(06 Marks)**

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

c. Find the nth derivative of $\dfrac{x+2}{x+1}+\log\left(\dfrac{x+2}{x+1}\right)$. **(07 Marks)**

3 a. State and prove Euler's theorem. **(06 Marks)**

b. Given $u=\sin\left(\dfrac{x}{y}\right)$, $x=e^t$, $y=t^2$, find $\dfrac{du}{dt}$ as a function of t. **(07 Marks)**

c. If $x=r\cos\theta$, $y=r\sin\theta$, find $\dfrac{\partial(x,y)}{\partial(r,\theta)}$ and $\dfrac{\partial(r,\theta)}{\partial(x,y)}$. **(07 Marks)**

4 a. Find the angle of intersection of the curves $r=a(1+\cos\theta)$ and $r=b(1-\cos\theta)$. **(06 Marks)**

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

c. Expand $e^{\sin x}$ by Maclaurin's series upto the term containing x^4. **(07 Marks)**

5 a. Obtain the reduction formula for $I_n=\int_0^{\pi/2}\sin^n x\,dx$ where n is a positive integer. **(06 Marks)**

b. Evaluate : $\int_1^5\int_1^{x^2} x(x^2+y^2)\,dx\,dy$. **(07 Marks)**

c. Evaluate : $\int_0^1\int_0^2\int_1^2 x^2yz\,dx\,dy\,dz$. **(07 Marks)**

6 a. Prove that $\beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

b. Show that $\Gamma(n) = \int_0^1 \left(\log\dfrac{1}{x}\right)^{n-1} dx$. **(07 Marks)**

c. Express $\int_0^{\pi/2} \sqrt{\tan\theta}\, d\theta$ in terms of Gamma function. **(07 Marks)**

7 a. Solve : $\dfrac{dy}{dx} = \dfrac{x(2\log x + 1)}{\sin y + y\cos y}$. **(06 Marks)**

b. Solve : $(1 + e^{x/y})dx + e^{x/y}\left(1 - \dfrac{x}{y}\right)dy = 0$. **(07 Marks)**

c. Solve : $(x^2 - ay)dx = (ax - y^2)dy$. **(07 Marks)**

8 a. Solve : $\dfrac{d^4y}{dx^4} + 8\dfrac{d^2y}{dx^2} + 16y = 0$. **(06 Marks)**

b. Solve : $(D-2)^2 y = 8(e^{2x} + \sin 2x)$. **(07 Marks)**

c. Solve : $(D^3 + 4D)y = \sin 2x$. **(07 Marks)**

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