National Institute of Technology, Raipur

III[rd] Semester, Endsem Exam, Dec. 2023

Digital Logic Design **Code EC103104EC** **Full Marks 50** **Time 3Hrs.**

Attempt all questions

Section-A (5 marks)

1. Write down the logical expression of full-adder outputs and implement the same using 2-input NAND gates. 1+2

2. Expand $A(\overline{A}+B)(\overline{A}+B+\overline{C})$ to maxterms. 2

Section –B (5 marks)

3. Define the following with a diagram where necessary: Propagation delay time, Set-up time, Hold time and race-around condition. 2

4. Differentiate between asynchronous and synchronous counters. What is the lock-out condition on counter. 2+1

Section-C (20 marks)

5. Explain the working of the 3-input TTL NAND gate circuit in Totem-pole configuration? 4

6. Explain the formation of inverter and 2-input NOR gate circuit usingCMOS logic family? 5

7. Implement the following logic function using an 8×1 MUX: 5

$$F(A,B,C,D)=\sum m(1,3,4,11,12,13,14,15)$$

8. Write down the excitation table of JK flip flop with the explanation. Show the design method of converting the D flip flop to JK flip flop. 2+4

Section-D (20 marks)

9. Differentiate between PLA and PAL. 3

10. Explain the working principle of 4-bit twisted ring counter using JK flip flops with its state diagram, sequence table and timing diagram. What are the advantages and disadvantages of this counter? 5+2

11. Design a JK counter that goes through states 3,4.6.7 and 3... . Is the counter self-starting? Modify the circuit such that whenever it goes to an invalid state it comes back to 3. 5+2+3

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National Institute of Technology Raipur
Department of Electronics and Communication Engineering
3rd Semester Examination 2023
Sub: Microelectronics Devices and Circuits (Subject Code- EC103102EC)

Time- 3 hrs **Full Marks- 50**

(Answer any 5 questions)

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1. (a) Find the resistivity of P-type Silicon with $N_A=10^{16}/cm^3$. Value of the $\mu_n=1110cm^2/V.s$ and $\mu_p=400\ cm^2/V.s$. [06]

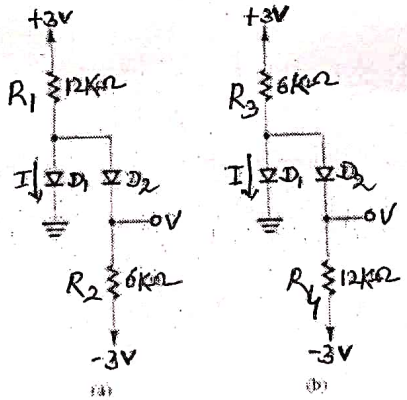
(b) Differentiate between drift and diffusion current. [04]

2.(a) Calculate Is and the current I for V = 750 mV for a PN junction for which $N_A = 10^{17}/cm^3$, $N_D = 10^{16}/cm^3$, A = 100 μm^2, $n_i = 1.5\times10^{10}/cm^3$, $L_p = 5\ \mu m$, $L_n = 10\ \mu m$, $D_p = 10\ cm^2/s$, and $D_n = 18\ cm^2/s$. [06]

(b) Use the Einstein relationship to find D_n and D_p for intrinsic silicon using $\mu_n=1350cm^2/V.s$ and $\mu_p=400\ cm^2/V.s$ [04]

3.(a) [06]

$R_1 = R_4 = 12K\Omega$
$R_2 = R_3 = 6K\Omega$



Assuming that the diodes in the above circuits are ideal, find the values of the labeled voltages (V) and currents (I).

(b) If we double the area of a BJT and decrease its V_{BE} by 60mV, then predict the change in I_C? [04]

4. (a) Design a voltage devider bias NPN transistor to estalish a current I_E=1mA with a power supply V_{CC}=12V. The value of $\beta = 100$. [06]

(b) What is base width modulation ? How it affects the output impedance of the amplifier? [04]

5. (a) A BJT having $\beta = 100$ is biased at a dc collector current of 1 mA. Find the value of g_m, r_e, and r_π at the bias point. [06]

(b) A 0.18-μm fabrication process of a MOS device is specified to have $t_{ox} = 4$ nm, $\mu_n = 450\ cm^2/V.s$, and $V_t = 0.5$ V. Find the value of the process transconductance parameter k'n. [04]

[5+5]

6. Write short notes on
   (a) VARACTOR Diode
   (b) Importance of negetive feedback

(Best of luck)

Roll. No. 2216903
CBCS

CODE: EC103103EC

B.TECH (THIRD SEMESTER REGULAR) EXAMINATION, 2023
SUBJECT: SIGNALS AND SYSTEMS
BRANCH: ELECTRONICS AND COMMUNICATION ENGG.

TIME: 3 HRS MAX. MARKS: 50

NOTE: Answer all questions.

Question No.- I [2,3, 2,2,1]

a) Explain Hybrid System with an example. Justify most of electronics systems that we encounter in day to day are Hybrid in nature.

b) Given $x(t) = \frac{1}{2}\,Cos(\omega t + 1), for -\frac{\pi}{\omega} \le t \le \frac{\pi}{\omega}$ *and 0 otherwise.*

i. Sketch the signal.
ii. Determine whether x(t) is energy signal or power signal.
iii. Calculate its average power or total energy.

c) Determine whether each of the following signal is periodic. If the signal is periodic find the fundamental period?

i. $x(t) = Cos\frac{t}{4} + Sin\frac{t}{3}$

ii, $x[n] = Cos\frac{1}{5}\pi n\,.\,Sin\frac{1}{5}\pi n$

d) Explain exponential test signals. Under what conditions do these signals becomes pure sinusoidal show mathematically their fundamental period.

e) For a discrete system given $x[n] = \delta[n+1] + 2\delta[n] + 3\delta[n-1]$ and $h[n] = -\delta[n+2] + 5\delta[n+1] + 3\delta[n]$ determine the output $y[n]$

Question No.-II [3,2,3,2]

a) Find the Laplace Transform of the following Signals:

(i) $x(t) = t^2\, e^{-2t}\, u(t)$

(ii) $x(t) = \int_0^t e^{-2\tau}\, cos(3\tau) d\tau$

(iii) $x(t) = 2t\frac{d}{dt} e^{-t}\, Sin\, t\, u(t)$

b) Find the inverse Laplace transform of the following function.

$$F(s) = \frac{(3s+2)}{s^2+4s+5} e^{-\pi s/2}$$

c) A system has impulse response $h[n] = \left(\frac{1}{2}\right)^n u[n]$ determine the input $x[n]$ to the system if output of the system is $y[n] = \delta[n-2]$

d) State and explain Parseval's Theorem. Prove that for total energy is conserved in transformation from time domain to frequency domain.

Question No.-III [3,3,3,3,3]

a) Input $x(t)$and output $y(t)$ of an LTI system is described by differential equation

$$\frac{d^2y(t)}{dt^2} + 6\frac{dy}{dt} + 8y(t) = 2x(t)$$

Determine the impulse response and step response of the system.

b) Explain the property orthogonality and show that $\text{Sin}(m\omega_0 t)\,\text{Sin}(n\omega_0 t)$ are orthogonal.

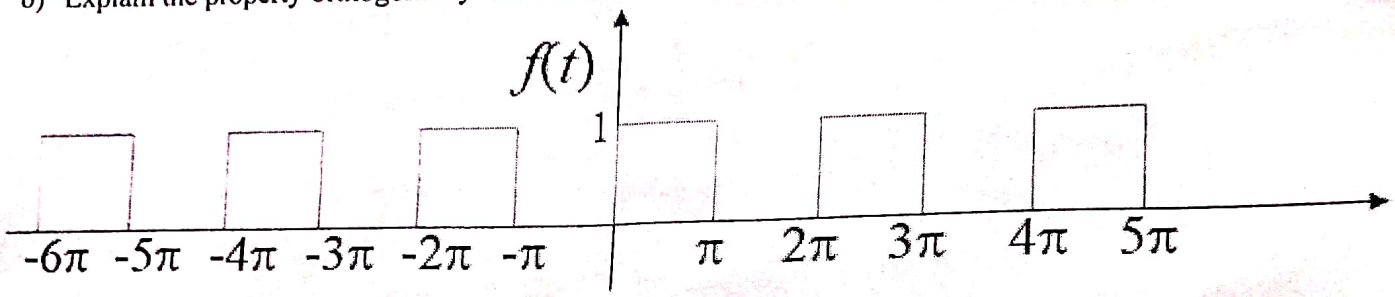


Figure No. I

c) Periodic train of pulses is shown in figure **No. I** Determine the Fourier coefficients for the given waveform.

d) Determine the compact complex form of Fourier series from its trigonometric form and explain the DC component associated with it .

e) Explain the conditions for distortion-less transmission through LTI system.

Question No.-IV **[2,3,4, 6]**

a) Explain quarter-wave symmetric for a waveform and demonstrate with an example.

b) Derive time domain expression for an Ideal Band Pass Filter (IBPF) centered at $\omega_c$rad/sec and has a bandwidth of ω_m rad/sec.

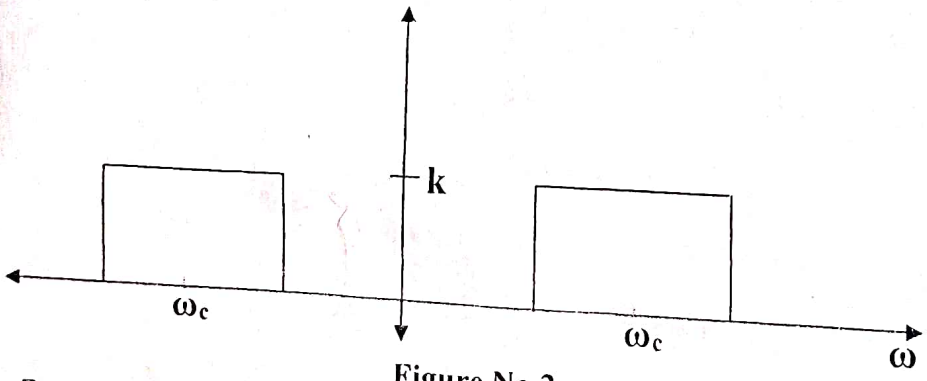


Figure No.2

c) Derive Fourier integral from compact complex form of Fourier series and explain its application for computing frequency spectrum.

d) Determine the discrete Fourier Series Representation for each of the following sequences.

1). X(n)= $\cos\frac{\pi}{3}n + \sin\frac{\pi}{4}n$

2). X(n)= $\cos^2\left[\frac{\pi}{8}n\right]$

****End***

CBCS

CODE: EC103105EC

B. Tech (Third Semester)Theory Examination December 2023
Branch: - Electronics & Communication Engg.
Subject: - Electronic Measurement and Instruments

Time: - Three Hours **Max Marks: - 50**

ALL SECTIONS AND QUESTIONS ARE COMPULSORY AND CARRY MARKS AS INDICATED

SECTION I (5 MARKS) ATTEMPT ANY ONE

Q1) Describe in detail the dynamic response of an instrument.

Q2) Explain in detail the various errors in measurement and its analysis.

SECTION II (5MARKS) ATTEMPT ANY ONE

Q3) Explain in detail the working and construction of Power factor meter.

Q4) Explain in detail the working and construction of watt-hour meter.

SECTION III (20 MARKS) ATTEMPT ANY TWO

Q5) Explain in detail DC bridges: Wheatstone bridge and Kelvin bridge.

Q6) Explain in detail one method each of displacement ,pressure and flow measurement

Q7) Explain in detail AC bridges Maxwell bridge, Hay bridge, Schering bridge, and Wein bridge,

SECTION IV(20MARKS) ATTEMPT ANY TWO

Q8) Explain in detail the construction and working of Cathode Ray Oscilloscope and Digital storage oscilloscope .

Q9) Derive the expression for the Electrostatic Deflections of Electron and Deflection Sensitivity.

Q10) Explain in detail the construction and working of Digital multimeter and Data Acquisition system in detail.

Roll No- 22116903

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF MATHEMATICS
THIRD SEMESTER OF ACADEMIC YEAR 2023-2024
BRANCH: ELECTRONIC AND TELECOMMUNICATION ENGINEERING

Subject Name: Mathematics III
Subject Code: MA103001MA
Maximum Marks: 50

END SEM Exam
Time: 3 hours

Unit-I

Q. 1: State and prove generating function for Legendre's polynomial. [5]

Unit-II

Q. 2: Solve the differential equations by Laplace transform [5]

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 5y = (\cos t - \sin t)\, e^{-2t}, \quad y(0) = 1,\ y'(0) = -3.$$

Unit-III

Q. 3: Attempt any four parts: [5+5+5+5]

(a) Consider the function $f(z)$ defined by

$$f(z) = \begin{cases} \dfrac{x^{\frac{4}{3}}y^{\frac{5}{3}} + ix^{\frac{5}{3}}y^{\frac{4}{3}}}{x^2+y^2}, & \text{if } z \neq 0, \\ 0, & \text{if } z = 0. \end{cases}$$

Show that Cauchy-Riemann equations satisfied at $z = 0$, but that $f(z)$ is not differentiable at $z = 0$.

(b) Solve Prove that $u = x^2 - y^2 + xy$ is a harmonic function. Determine its harmonic conjugate and find corresponding function $f(z)$ in term of z.

(c) Obtain the expression for $\dfrac{(z-2)(z+2)}{(z+1)(z+4)}$ which are valid when
(i) $|z| < 1$, (ii) $1 < |z| < 4$, (iii) $|z| > 4$.

(d) (i) Using Cauchy integral formula, calculate the integral

$$\int_C \frac{\cosh(\pi z)dz}{z(z^2+1)}, \quad \text{where } C \text{ is circle } \ |z| = 2.$$

(ii) Determine the order of the poles and values of residues of the function $\dfrac{z+3}{z^2-2z}$.

(e) Prove that

$$\int_0^{2\pi} \frac{\cos^2 3\theta d\theta}{1 - 2p\cos 2\theta + p^2} = \frac{\pi(1-p+p^2)}{1-p}, \quad 0 < p < 1.$$

Unit-IV

Q. 4: Attempt any four parts: [5+5+5+5]

(a) (i) Prove that in complete graph with n vertices there must be $\frac{n(n-1)}{2}$ edges.

(ii) A simple graph has with 35 edges four vertices of degree five, five vertices of degree four, four vertices degree of three. Find the number of vertex with degree three.

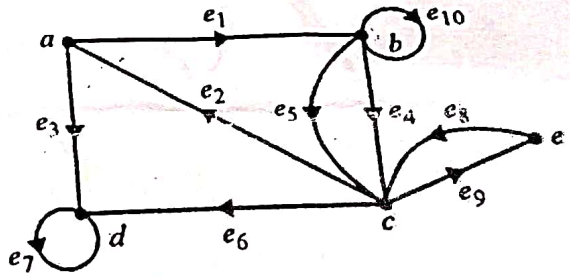
(b) Define with example following below

(i) Connected graph (ii) Euler graph (iii) Tree (iv) Pendent vertex (v) Binary tree.

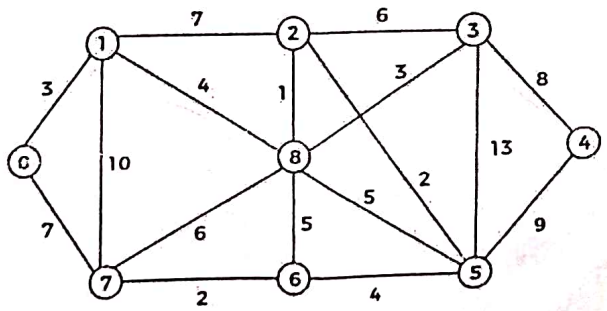
(c) (i) Draw the digraph whose Adjacency matrix A is given by

$$A = \begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

(ii) Determine the incidence matrix by the graph below :



(d) Find the shortest path(Dijkstra's Algorithm) between 0 to 4 in the following weighted graph



(e) Define the spanning tree and draw any ten spanning tree of K_5.

END

Roll No. 2211693

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

Department of Electronics and Communication

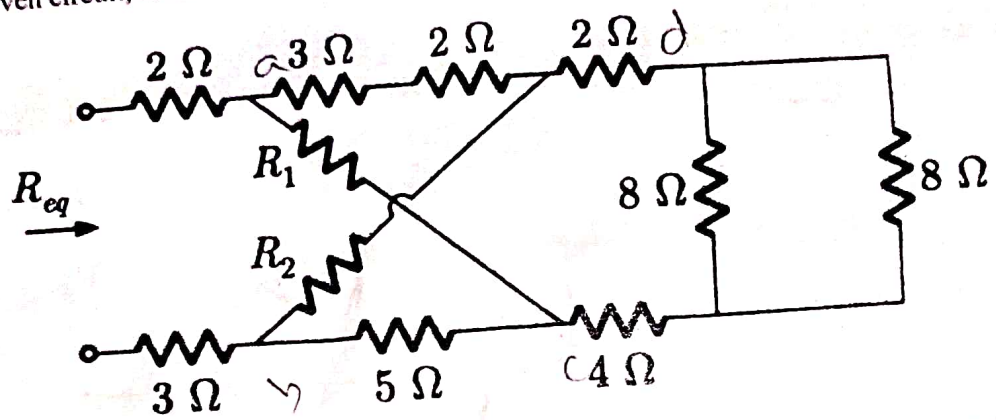
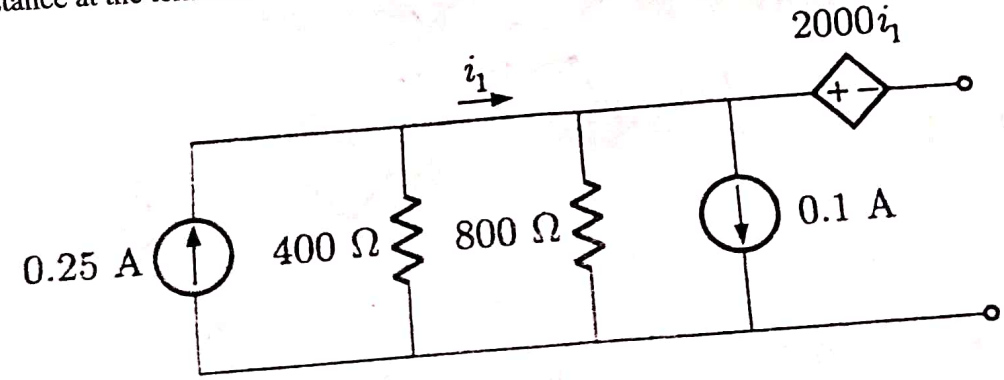
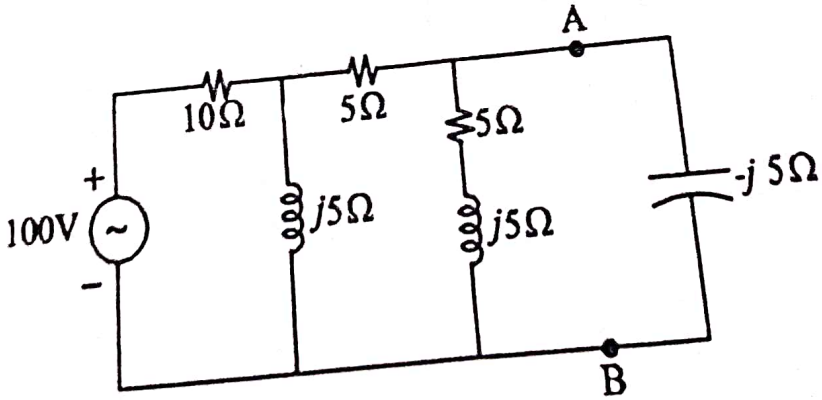
END SEM Exams (Dec – 2023)

SUB: Network Analysis and Synthesis **CODE: EC103101EC**

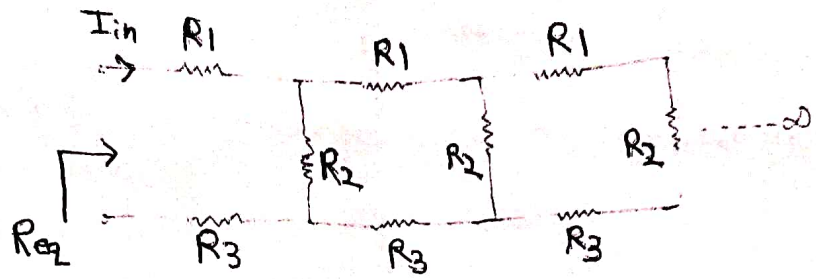
SEM: III

Max. Marks: 50

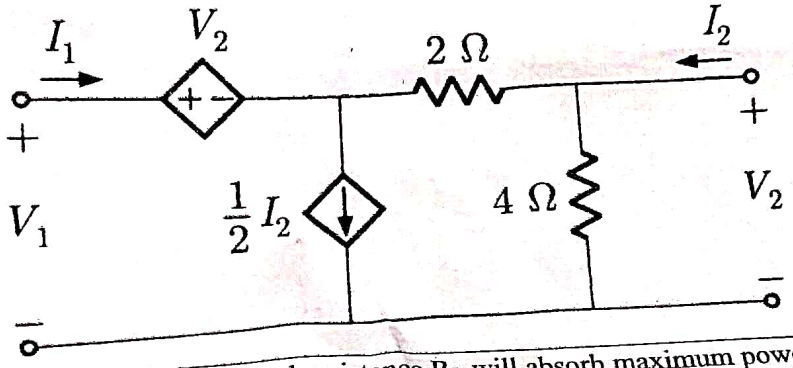
NOTE: 1. ATTEMPT ALL QUESTIONS.

Q: 1	In the given circuit, If R_1=R_2=0 ohm, then what is the value of R_{eq}? 	7
Q: 2	In the below circuit, find out the value of equivalent Thevenin's voltage and Thevenin's resistance at the terminal. 	7
Q: 3	For the below network, Find out the current through the source. 	5

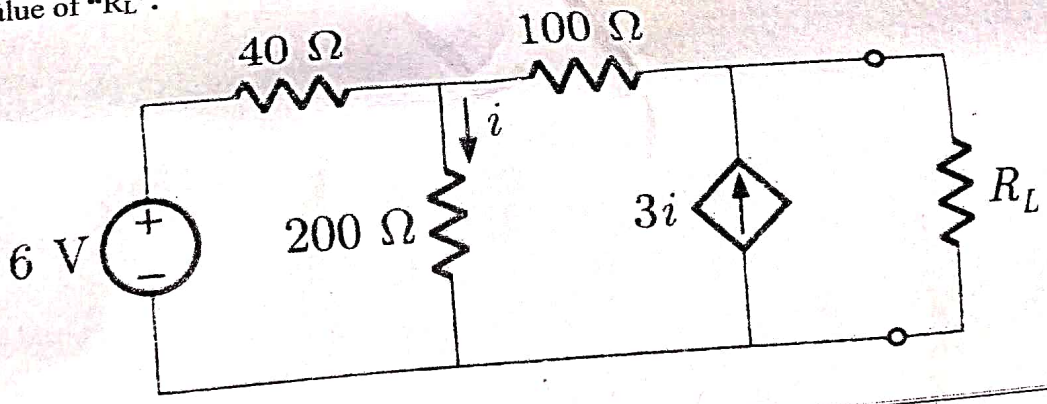
Q: 4 Find out the driving point input impedance (R_{in} or R_{eq}) value for the below network. **5**



Q: 5 Calculate The h-parameter matrix [h] for the below circuit. **7**



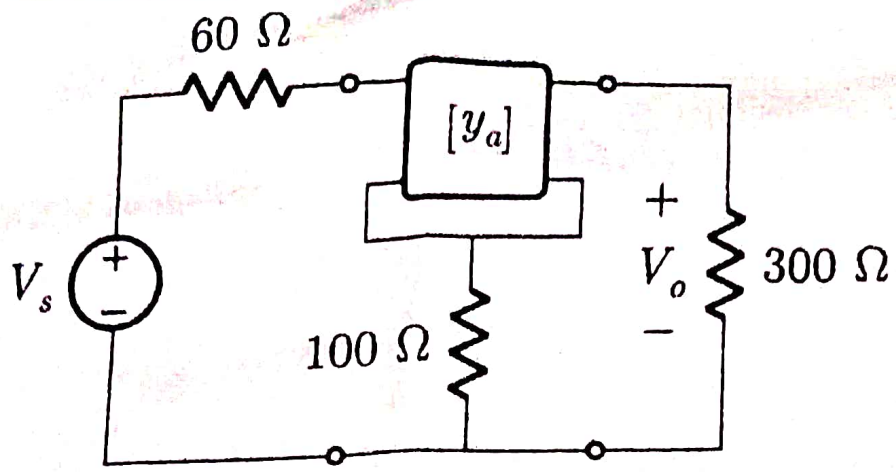
Q: 6 In the circuit shown below, if the load resistance R_L will absorb maximum power, then find out the value of "R_L". **7**



Q: 7 For the Two-port network shown below, the admittance parameter matrix is [y_a]: **7**

$$[y_a] = \begin{bmatrix} 2 & 0 \\ 0 & 10 \end{bmatrix} \text{ mS}$$

Find out the value of V_o/V_s (Output/Input):



Q: 8 Calculate the power delivered/absorbed by 4mA source for the following circuit. **5**