M/P ENT - 114

Seat No.	

Total No. of Pages : 16

M.Phil. / Ph.D. Entrance Examination, August - 2018

ENGINNERING AND TECHNOLOGY

Electronics Engineering

Day and Date : Saturday, 11 - 08 - 2018 **Total Marks : 100**

Time : 04.00 p.m. to 06.00 p.m.

Instructions :

1) **All questions are compulsory.**
2) **Each question carries 2 marks.**
3) **Answers should be marked in the given OMR answer sheet by darkening the appropriate option.**
4) **Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.**
5) **Follow the instructions given on OMR Sheet.**
6) **Rough work shall be done on the sheet provided at the end of question paper.**
7) **Only non programmable calculators are allowed.**

RESEARCH METHODOLOGY

1. A Hypothesis must be _____.

   A) Diffuse B) Specific

   C) Slow D) Speedy

2. In the process of conducting research 'Formulation of Hypothesis" is followed by

   A) Statement of Objectives B) Analysis of Data

   C) Selection of Research Tools D) Collection of Data

3. One or two tail test will determine

   A) If the two extreme values (min or max) of the sample need to be rejected

   B) If the hypothesis has one or possible two conclusions

   C) If the region of rejection is located in one or two tails of the distribution

   D) None of the above

4. The first purpose of a survey is to _____.

A) Description
B) Evaluation
C) Propagation
D) Provide Information

5. In a survey the number questions is

A) Unlimited
B) Limited
C) Both limited and unlimited
D) None of the above

6. The null hypothesis for the Mann-Whitney U test is used to test that

A) Two samples are from different populations
B) Two samples are from different populations but have the same mean
C) Two samples are from the same population and have the same mean
D) Two samples are from the same population and have the same median

7. In Testing the statistical hypothesis, which of the following statement is false

A) The critical region is the values of the test statistic for which we reject null hypothesis.
B) The level of significance is the probability of type I error
C) The p-value measures the probability that the null hypothesis is true
D) None of the above

8. The final stage is a survey is _____.

A) Reporting
B) Fieldwork
C) Assignment
D) Calculation

9. Surveys on the basis of subject matter are of two types (1) Social survey and (2) _____.

A) Economic Survey
B) Deep survey
C) Intensive Survey
D) Extensive Survey

10. Chi-square test for independence assesses which of the following?
    A) It assesses whether there is a relationship between two categorical variables
    B) It assesses whether there is a relationship between the population and the sample
    C) It assesses whether there is a significant difference between two categorical variables
    D) It assesses whether there is significant difference between scores taken at time 1 and those taken at time 2

11. Conclusions from qualitative research are
    A) less certain than from quantitative research
    B) of little practical use.
    C) of descriptive value only.
    D) seldom defensible.

12. In a Three year Research Programme _____ time can be devoted for preliminary works.
    A) 20% B) 50%
    C) 17% D) 25%

13. For collection of Data _____ time is devoted.
    A) 50% B) 25%
    C) 75% D) 33%

14. How many dependent variables must you have for an ANOVA to be conducted?
    A) ordinal variables B) nominal variables
    C) Only 1 continuous variable D) None of these

15. What is the function of a post-test in ANOVA?
    A) Determine if any statistically significant group differences have occurred.
    B) Describe those groups that have reliable differences between group means.
    C) Set the critical value for the F test (or chi-square).
    D) None of the above

16. Final stage in the Research Process is

A) Problem formulation
B) Data collection
C) Data Analysis
D) Report Writing

17. A Research Report is a formal statement of _____.

A) Research Process
B) Research Problem
C) Data Collection
D) Data Editing

18. A comprehensive full Report of the research process is called

A) Thesis
B) Summary Report
C) Abstract
D) Article

19. _____ is a statistical technique that identifies homogenous subgroups.

A) Factor analysis
B) Multivariate analysis of variance
C) Cluster analysis
D) Discriminant analysis

20. Data originating from studies that are conducted by others and for a different purpose than the one for which the data are being reviewed are called _____ data.

A) primary
B) secondary
C) quantitative
D) descriptive

21. When analyzing nominal data, which measure of central tendency is appropriate?

A) mean
B) mode
C) median
D) range

22. A short summary of Technical Report is called

A) Article
B) Research Abstract
C) Publication
D) Guide

23. Bibliography means

A) Foot Note
B) Quotations
C) List of Books referred
D) Biography

24. Using the _____ sampling technique can result in a skewed sample if periodicity exists in the population.

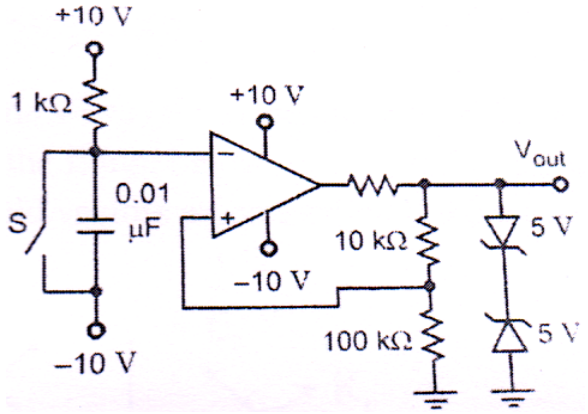
A) simple random
B) systematic
C) stratified
D) cluster

25. Which of the following measures become larger as the data is more dispersed - the mean, median, range, variance or standard deviation?

A) The mean and the median.
B) The median and range.
C) The mean, variance and standard deviation.
D) The range, variance and standard deviation.

SUBJECT SPECIFIC

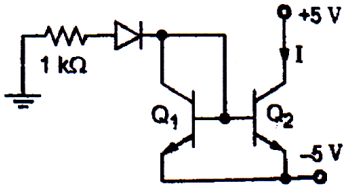
26. The Switch S in the circuit of the figure is initially closed, it is opened at time $t = 0$. You may neglect the zener diode forward voltage drop. What is the behavior of V_{out} for $t > 0$?



A) It makes a transition from –5 V to +5V at 12.98μs.
B) It makes a transition from –5 V to +5V at 2.57μs.
C) It makes a transition from +5 V to –5V at 12.98μs.
D) It makes a transition from +5 V to –5V at 2.57μs.

27. Two Perfectly matched silicon transistor are connected as shown in the figure. Assuming the β of the transistor to be very high and the forward voltage drop in the diodes to be 0.7V the value of current I is

A) 0 mA
B) 3.6mA
C) 4.3 mA
D) 5.6mA



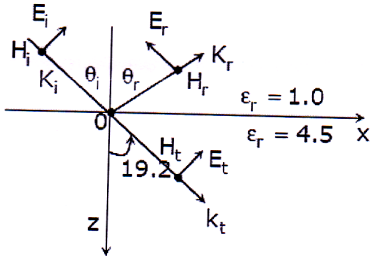
28. Three companies X, Y and Z supply computers to a university. The percentage of computers supplied by them and the probability of those being defective are tabulated below

Company	%of Computer Supplied	Probability of being supplied defective
X	60%	0.01
Y	30%	0.02
Z	10%	0.03

Given that a computer is defective, the probability that was supplied by *Y* is

A) 0.1 B) 0.2
C) 0.3 D) 0.4

29. A monochromatic plane wave of wavelength λ. = 600 μm is propagating in the direction as shown in the figure below. E_i, E_r, and E_t denote incident, reflected, and transmitted electric field vectors associated with the wave.



The angle of incidence θ_i and the expression for E_i are

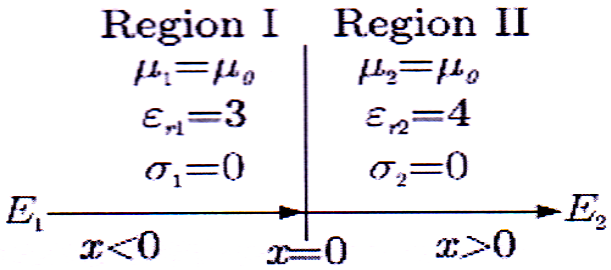
A) 60°and $\frac{E_0}{\sqrt{2}}(\hat{a}_x - \hat{a}_z)e^{-J\frac{\pi\times10^4(x+z)}{3\sqrt{2}}}$ V/m

B) 45°and $\frac{E_0}{\sqrt{2}}(\hat{a}_x + \hat{a}_z)e^{-J\frac{\pi\times10^4 z}{3}}$ V/m

C) 45°and $\frac{E_0}{\sqrt{2}}(\hat{a}_x - \hat{a}_z)e^{-J\frac{\pi\times10^4(x+z)}{3\sqrt{2}}}$ V/m

D) 60°and $\frac{E_0}{\sqrt{2}}(\hat{a}_x - \hat{a}_z)e^{-J\frac{\pi\times10^4 z}{3}}$ V/m

30. A medium is divide into regions I and II about $x = 0$ plane, as shown in the figure below.



An electromagnetic wave with electric field $E_1 = 4\hat{a}_x + 3\hat{a}_y + 5\hat{a}_z$ is incident normally on the interface from region *I*. The electric file E_2 in region II at the interface is

A) $E_2 = E_1$

B) $4\hat{a}_x + 0.75\hat{a}_y - 1.25\hat{a}_z$

C) $3\hat{a}_x + 3\hat{a}_y + 5\hat{a}_z$

D) $-3\hat{a}_x + 3\hat{a}_y + 5\hat{a}_z$

31. A BPSK scheme operating over an AWGN channel with noise power spectral density of *N*0/2, uses equiprobable signals $S_1(t) = \sqrt{\frac{2E}{T}}\sin(\omega_c t)$ and $S_2(t) = \sqrt{\frac{2E}{T}}\sin(\omega_c t)$ over the symbol interval (0, *T*). If the local oscillator in a coherent receiver is ahead in phase by 45° with respect to the received signal, the probability of error in the resulting system is

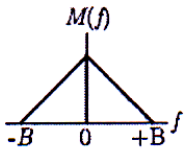
A) $Q\left(\sqrt{\frac{2E}{N_0}}\right)$

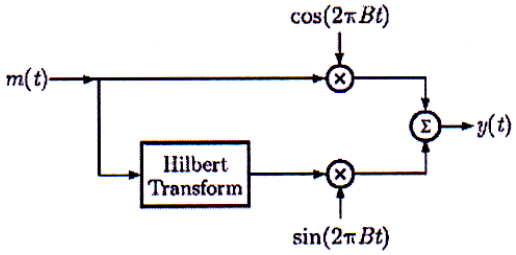
B) $Q\left(\sqrt{\frac{E}{N_0}}\right)$

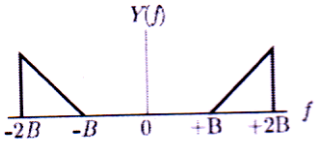
C) $Q\left(\sqrt{\frac{E}{2N_0}}\right)$

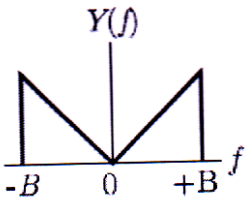
D) $Q\left(\sqrt{\frac{E}{4N_0}}\right)$

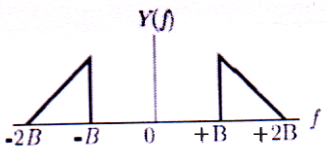
32. In the following scheme, if the spectrum M(f) of m(t) is as shown, then the spectrum Y(f) of y(t) will be

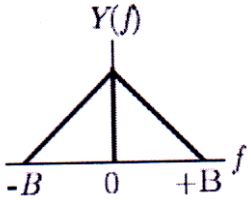




A) 

B) 

C) 

D) 

33. Consider the following devices

i. BJT in CB mode

ii. BJT in CE mode

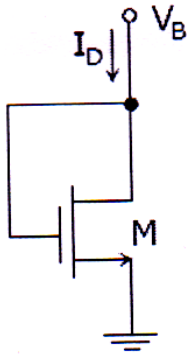
iii. JFET

iv. MOSFET

The correct sequence of these devices in increasing order of their input impedance is

A) i,ii,iii,iv
B) ii,i,iii,iv
C) ii,i,iv,iii
D) i,iii,ii,iv

34. The small-signal resistance (i.e., dV_B / dI_D) in kW offered by the n-channel MOSFET M shown in the figure below, at a bias point of VB = 2 V is (device data for M: device Transconductance parameter $k_n = \mu_n C_{ox}$ (W/L) = $40\mu A/V^2$ threshold voltage V_{TN}=lv and neglect body effect and channel length modulation effects)



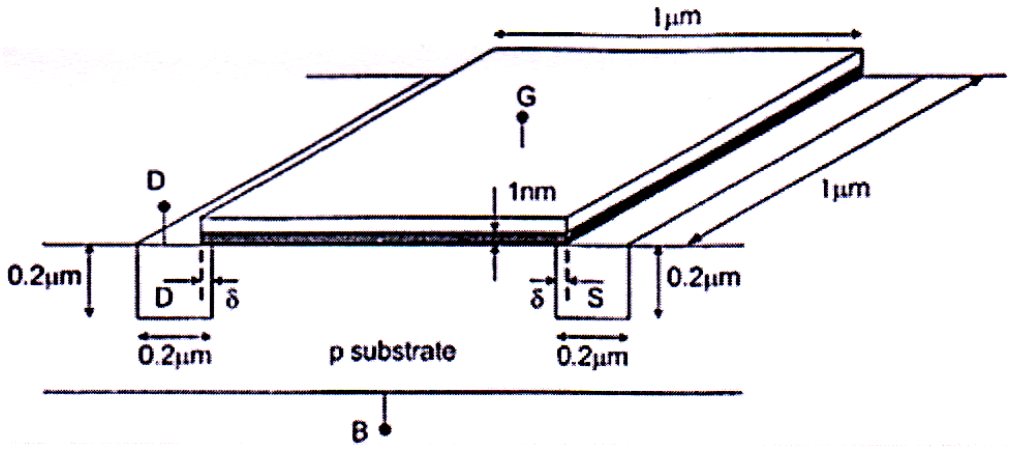
A) 12.5

B) 25

C) 50

D) 100

35. In the three dimensional view of a silicon n-channel MOS transistor shown below, δ = 20 nm. The transistor is of width 1 μm. The depletion width formed at every p-n junction is 10 nm. The relative permitivities of Si and SiO_2, respectively, are 11.7 and 3.9, and $\varepsilon_0 = 8.9 \times 10^{-12}$F/m.



The source-body junction capacitance is approximately

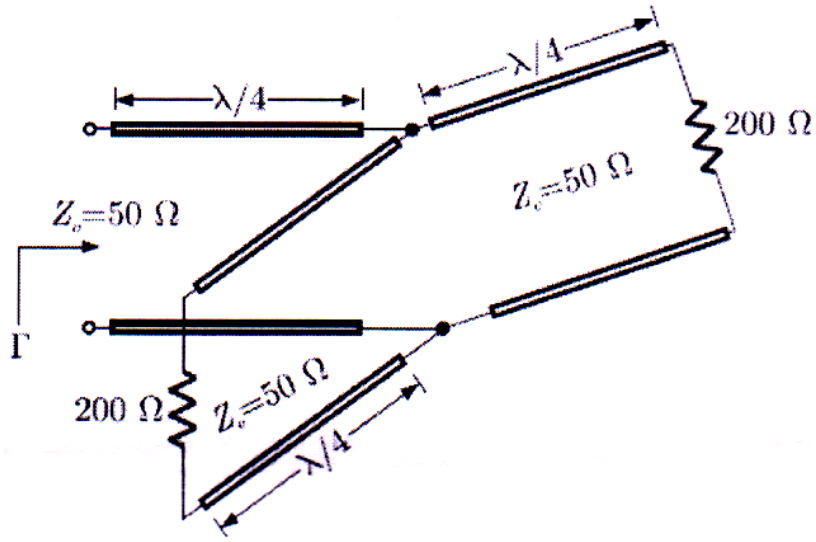
A) 2 fF

B) 7 fF

C) 2 pF

D) 7 pF

36. The parallel branches of a 2-wire transmission line re terminated in 100Ω and 200Ω resistors as shown in the figure. The characteristic impedance of the line is $Z_0 = 50\Omega$ and each section has a length of $\frac{\lambda}{4}$. The voltage reflection coefficient Γ at the input is



A) $-j\frac{7}{5}$

B) $\frac{7}{5}$

C) $-j\frac{5}{7}$

D) $\frac{5}{7}$

37. A system described by a linear, constant coefficient, ordinary, first order differential equation has an exact solution given by y(t) for t > 0, when the forcing firnction is x(t) and the initial condition is y(0). If one wishes to modify the system so that the solution becomes – 2y(t) for t> 0 , we need to

A) change the initial condition to – y(0) and the forcing function to 2x(t)

B) change the initial condition to 2y(0) and the forcing function to – x(t)

C) change the initial condition to j 2y(0) and the forcing function to j 2x(t)

D) change the initial condition to – 2y(0) and the forcing function to – 2x(t)

38. If $x(n) \leftrightarrows$ is N-point Discrete Fourier Series and

$$x(k) = \frac{1}{N} \sum_{n=<N>} x(n) \exp(JK\omega_0 n)$$

$\omega_0 = 2\pi/N$ Match the Discrete Fourier series pairs and Properties

P.	$\sum_{n=<N>} \lvert x(n) \rvert^2$	1.	$\frac{1}{N} \sum \lvert x(k) \rvert^2$
Q.	$x(n)$	2.	$X(-k)$
R.	$x(-n)$	3.	$\frac{1}{N} x(k)$
S.	$x(n-n_0)$	4.	$N \sum \lvert x(k) \rvert^2$
		5.	$x(k)\exp(-JK\omega_0 n_0)$
		6.	$Nx(-k)$

	P	Q	R	S
A)	1	2	3	4
B)	4	3	2	5
C)	5	3	2	1
D)	3	1	4	5

39. A MOS capacitor made using p type substrate is in the accumulation mode. The dominant charge in the channel is due to the presence of

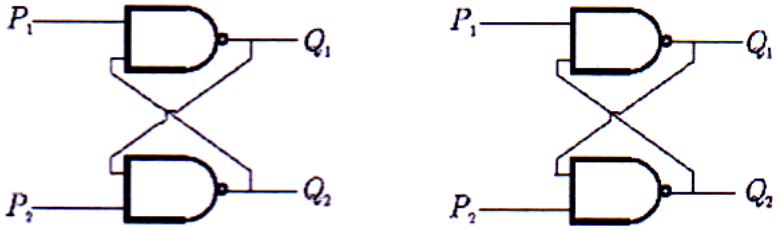
A) holes

B) electrons

C) positively charged ions

D) negatively charged ions

40. Refer to the NAND and NOR latches shown in the figure. The inputs (P_1,P_2) for both latches are first made (0, 1) and then, after a few seconds, made (1, 1). The corresponding stable outputs (Q_1, Q_2) are



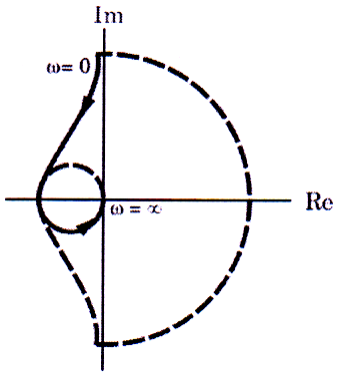
A) NAND : first (0, 1) then (0, 1) NOR: first (1, 0) then (0, 0)

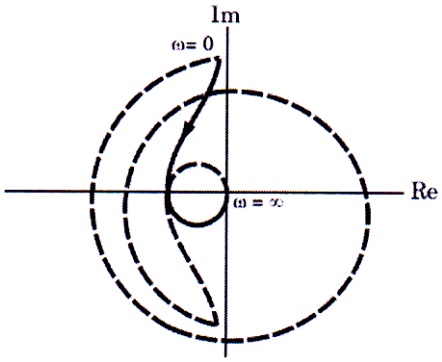
B) NAND : first (1, 0) then (1, 0) NOR: first (1, 0) then (1, 0)

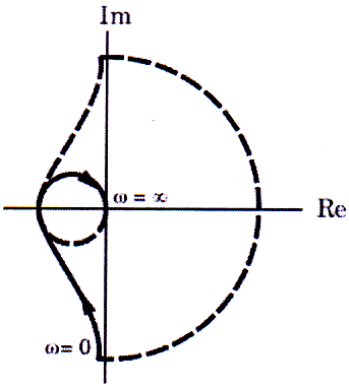
C) NAND : first (1, 0) then (1, 0) NOR: first (1, 0) then (0, 0)

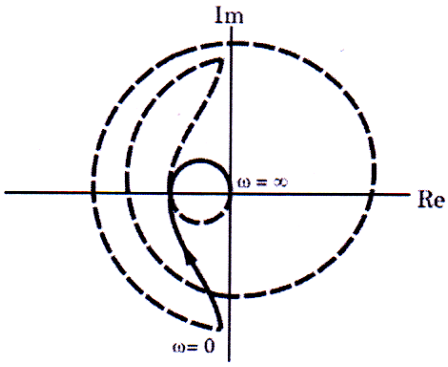
D) NAND : first (1, 0) then (1, 1) NOR: first (0, 1) then (0, 1)

41. The open loop transfer function of a system is $G(S)=\dfrac{k(1+S)^2}{S^3}$ The Nyquist plot for this system is

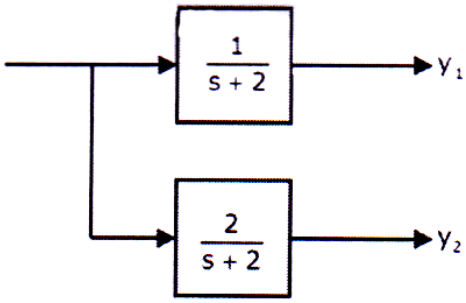
A)


B)


C)


D)


42. The block diagram of a system with one input it and two outputs yl and y2 is given below.



A state space model of the above system in terms of the state vector x and the output vector

$\underline{y} = [y1,\ y2]^T$ is

A) $\dot{\underline{x}} = [2]\underline{x} + [1]\underline{u};$ $\underline{y} = [1\ 2]\underline{x};$

B) $\dot{\underline{x}} = [-2]\underline{x} + [1]\underline{u};$ $\underline{y} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}\underline{x};$

C) $\dot{\underline{x}} = \begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}\underline{x} + [\begin{matrix} 1 \\ 2 \end{matrix}]\underline{u};$ $\underline{y} = [1\ 2]\underline{x};$

D) $\dot{\underline{x}} = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}\underline{x} + [\begin{matrix} 1 \\ 2 \end{matrix}]\underline{u};$ $\underline{y} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}\underline{x};$

For Questions Q43, Q44 there are two statements Assertion (A) and reason (R) Choose

A) Both (A) and (R) are true and (R) is the correct reason for (A)

B) Both (A) and (R) are true and (R) is not correct reason for (A)

C) Both (A) and (R) are true and (R) are false

D) (A) is true but (R) is false

43. Assertion (A) : A system with input $x(t)$ and output $y(t)$ given by

$Y(t) = t\,x^2(t) + 4(t-1)$ is time varying

Reason (R) : The output for x $(t-t_0)$ is equal to $t\,x^2(t-t_0) + 4\,x(t-1-t_0)$

44. Assertion (A): The Fourier transform of $u(t)$ can be obtained from its by Substituting s = $j\omega$

Reason (R) : The region of convergence of $u(t)$ for its Laplace transform to be defined includes the imaginary axis in the s- plane.

45. Consider a silicon p - n junction at room temperature having the following parameters;

Doping on the n-side 11017 = # cm–3

Depletion width on the n-side = 0.1 μm

Depletion width on the p–side = 1.0 μm

Intrinsic carrier concentration 1.4 1010 = # cm–3

Thermal voltage =26 mV

Permittivity of free space 8.85 10 14 = # – F.cm–1

Dielectric constant of silicon = 12

The peak electric field in the device is

A) 0.15 MV . cm^{-1}, directed from *p* –region to *n* –region

B) 0.15 MV . cm^{-1}, directed from *n* –region to *p* –region

C) 1.80 MV . cm^{-1}, directed from *p* –retion to *n* –region

D) 1.80 MV . cm^{-1}, directed from *n* –region to *p* –region

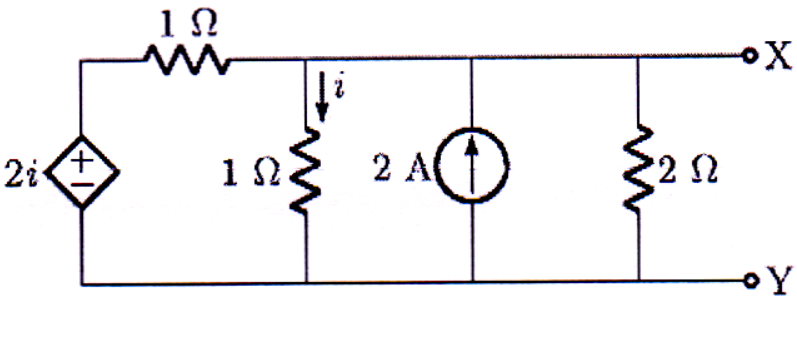
46. For the circuit shown in the figure, the Thevenin voltage and resistance looking into X –Yare

A) $\frac{4}{3}V, 2\Omega$

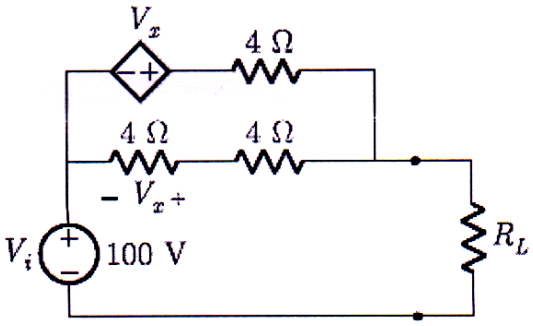
B) $4V, \frac{2}{3}\Omega$

C) $\frac{4}{3}V, \frac{2}{3}\Omega$

D) 4V,2Ω



47. In the circuit shown, what value of RL maximizes the power delivered to RL?



A) 2.4Ω

B) $\frac{8}{3}\Omega$

C) 4Ω

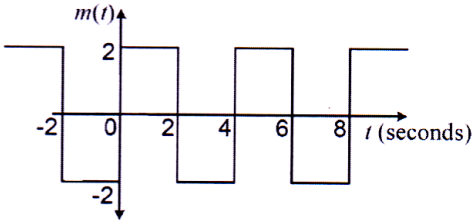
D) 6Ω

48. A fair coin is tossed till head appears for the first time. The probability that the number of required tosses is odd is

A) 1/3 B) 1/2

C) 2/3 D) 3/4

49. The signal $m(t)$ as shown is applied both to a phase modulator (with k_p as the phase constant) and a frequency modulator (with k_f as the frequency constant) having the same carrier frequency.



The ratio $k_p k_f$ (in rad/Hz) for the same maximum phase deviation is

A) 8π B) 4π

C) 2π D) Π

50. The transmission line with a characteristic impedance of 100 Ω is used to match a 50 Ω section to a 200 Ω section. If the matching is to be done both at 429 MHz and 1 GHz, the length of the transmission line can be approximately

A) 82.5 cm B) 1.05 m

C) 1.58 m D) 1.75 m

Rough Work