M. Sc. (Electronics) (Second Semester)

EXAMINATION, July, 2022

NETWORK ANALYSIS & SENTHESIS

Paper Code				
ELC	2	0	1	(N)

Time : 1:30 Hours]　　　　　　　　　　　　　　　[*Maximum Marks : 100*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 60 questions. Examinee is required to answer any 50 questions in the OMR Answer-Sheet provided and not in the question booklet. If more than 50 questions are attempted by student, then the first attempted 50 questions will be considered for evaluation. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 60 प्रश्न हैं। परीक्षार्थी को किन्हीं 50 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। यदि छात्र द्वारा 50 से अधिक प्रश्नों को हल किया जाता है तो प्रारम्भिक हल किये हुए 50 उत्तरों को ही मूल्यांकन हेतु सम्मिलित किया जाएगा। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page)　　　　　　(शेष निर्देश अन्तिम पृष्ठ पर)

(Only for Rough Work)

1. Application of Norton's theorem to a circuit yields :

    (A) equivalent current source and impedance in series

    (B) equivalent current source and impedance in parallel

    (C) equivalent impedance

    (D) equivalent current source
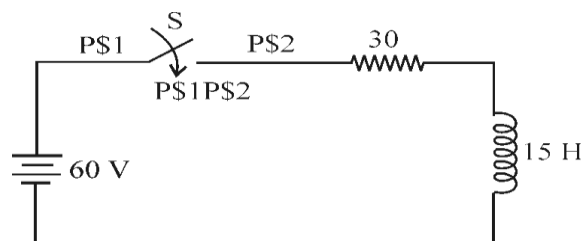
2. The expression of current in R-L circuit is :

    (A) $i = (V/R) (1 + \exp ((R/L) t))$

    (B) $i = - (V/R) (1 - \exp ((R/L) t))$

    (C) $i = - (V/R) (1 + \exp ((R/L) t))$

    (D) $i = (V/R) (1 - \exp ((R/L) t))$

3. After how many time constants, the transient part reachers more than 99 percent of its final value ?
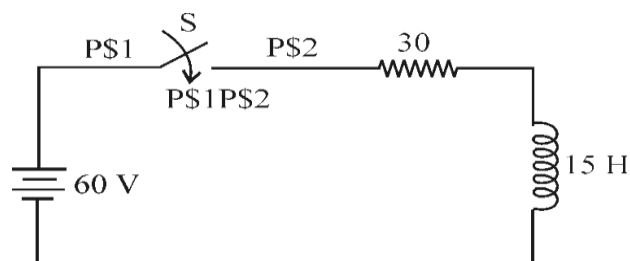
    (A) 2

    (B) 3

    (C) 4

    (D) 5

4. A series R-L circuit with R = 30 Ω and L = 15 H has a constant voltage V = 60 V applied at t = 0 as shown in the figure. Determine the current (A) in the circuit at $t = 0^+$.

    (A) 1

    (B) 2

    (C) 3

    (D) 0

5. The expression of current obtained from the circuit in terms of differentiation from the circuit shown below :
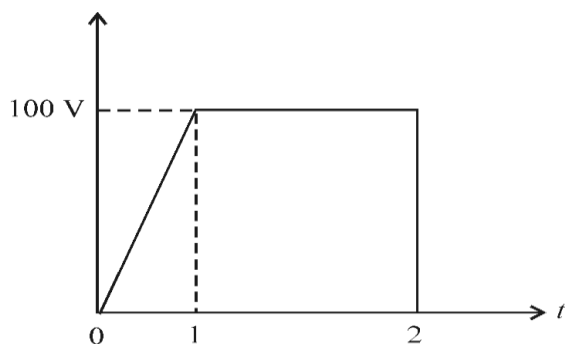

    (A) $di/dt + i = 4$

    (B) $di/dt + 2i = 0$

    (C) $di/dt + 2i = 4$

    (D) $di/dt - 2i = 4$

6. Two ports containing no sources in their branches are called :

   (A) active ports

   (B) passive ports

   (C) one port

   (D) three port

7. The rms value of wave in figure is :

   (A) about 95 V

   (B) about 80 V

   (C) about 50 V

   (D) about 75 V

8. An RLC series circuit is underdamped. To make it overdamped, the value of R :

   (A) has to be increased

   (B) has to be decreased

   (C) has to be increased to infinity

   (D) has to be reduced to zero

9. In a minimum function :

   (A) the degree of numerator and denominator are equal

   (B) the degree of numerator and denominator are unequal

   (C) the degree of numerator is one more than degree of denominator

   (D) the degree of numerator is one less than degree of denominator

10. $H(s) = \dfrac{V(s)}{I(s)} = \dfrac{s+4}{(s+3)^2}$ and $i(t)$ is a unit step, then $V(t)$ in the steady state is given by :

    (A) 4/9

    (B) 4/3

    (C) 0

    (D) 1

11. When a current source I is suddenly connected across a two terminal relaxed RC circuit at time $t = 0$, the voltage across the current source is shown in figure. The RC circuit is :
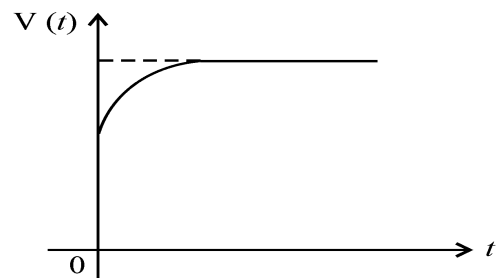
    (A) a series combination of R and C

    (B) a parallel combination of R and C

    (C) a series combination of R and parallel combination of R and C

    (D) a pure capacitor
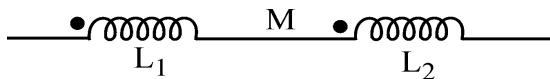
12. For a transmission line open circuit and short circuit impedances are 20 Ω and 5 Ω. Then characteristic impedance is :

   (A) 100 Ω

   (B) 20 Ω

   (C) 50 Ω

   (D) 10 Ω

13. An RLC series circuit has R = 8Ω, $X_L = 8$ Ω and $X_c = 8$ Ω. Its impedance is :

   (A) $8 + j\,16$ Ω

   (B) $8 + j\,8$ Ω

   (C) 8 Ω

   (D) 18 Ω

14. In figure the total inductance of the circuit is

   (A) $L_1 + L_2$

   (B) $L_1 + L_2 + M$

   (C) $L_1 + L_2 + 2M$

   (D) $L_1 + L_2 - M$

15. Double integration of unit step function leads to :
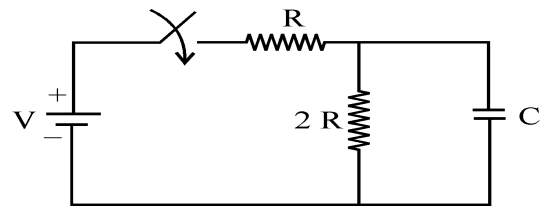
   (A) an impulse

   (B) a parabola

   (C) a ramp

   (D) a doublet

16. A network has 10 nodes and 17 braches. The number of different node pairs is :

   (A) 7

   (B) 9

   (C) 10

   (D) 45

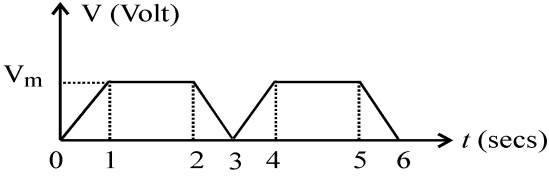17. The time constant of the network shown in figure is :

   (A) RC

   (B) 3 RC

   (C) 2/3 RC

   (D) 3/2 RC

18. If absolute potential of A is – 8 V and that of B is – 16 V, V_{AB} is equal to :

   (A) 24 V

   (B) 12 V

   (C) 8 V

   (D) 14 V

19. An RLC series circuit is excited by 200 V, 100 Hz supply, The current is 20 A. If $R = 10\ \Omega$, $X_L = 50\ \Omega$, X_C is :

    (A) $10\ \Omega$

    (B) $14.14\ \Omega$

    (C) $7.07\ \Omega$

    (D) $50\ \Omega$

20. For a given voltage four heating coils will give maximum heat when connected :

    (A)   in parallel

    (B)   in series

    (C)   with two parallel pairs in series

    (D)   with one pair in parallel and the other two in series

21. The function :

$$z(s) = \frac{s\left(s^2 + a\right)}{\left(s^2 + 1\right)\left(s^2 + 16\right)}$$

    (A)   is a reactance function

    (B)   is an RC function

    (C)   is an RL function

    (D)   may be reactance function or RC function

22. The poles of an RC function :

    (A)   are simple and lie or negative real axis

    (B)   are simple and lie on ω axis

    (C)   must be complex conjugate

    (D)   may be anywhere on s plane

23. Damping ratio =

    (A)   actual resistance/critical resistance

    (B)   critical resistance/actual resistance

    (C)   critical resistance

    (D)   None of the above

24. For an R-C impedance function, the residues at all poles are :

    (A)   real

    (B)   imaginary

    (C)   real and positive

    (D)   positive

25. A two-port network is reciprocal if and only if :

    (A) $Z_{11} = Z_{22}$

    (B) $BC - AD = -1$

    (C) $Y_{12} = Y_{21}$

    (D) $h_{12} = h_{21}$

26. In terms of ABCD parameters, the image parameter Z_{11} is equal to :

(A) AC/BD

(B) BD/AC

(C) AB/CD

(D) AD/BC

27. While drawing vector diagram for a series circuit, the reference vector is :

(A) voltage

(B) current

(C) power

(D) phase angle

28. The voltage transfer functions to two port circuits connected in cascade can be easily found from :

(A) product of individual ABCD matrices

(B) product of voltage transfer functions of two networks

(C) sum of z matrices

(D) sum of h matrices

29. If a function $Z(s)$ has a pole at infinity, then :

(A) the degrees of numerator and denominator are equal

(B) the degree of numerator is one higher than that of denominator

(C) the degree of denominator is one higher than that of numerator

(D) the difference between the degrees of numerator and denominator is 0 or 1

30. For the wave shown in figure, the average value is :

(A) $0.5\ V_m$

(B) $\dfrac{2}{3}\ V_m$

(C) $0.85\ V_m$

(D) $0.75\ V_m$

31. A circuit is said to be lumped when physical dimensions of all the components are :

(A) greater compared with wavelength of electromagnetic signal

(B) small compared with wavelength electromagnetic signal

(C) negligible compared with wavelength of electromagnetic signal

(D) equal compared with wavelength of electromagnetic signal

32. **Assertion (A)** : Q factor of a series resonant circuit is $\dfrac{1}{R}\sqrt{\dfrac{L}{C}}$.

Reasons (R) : High Q means better selectivity.

(A) Both (A) and (R) are true and R is the correct explanation of A

(B) Both (A) and (R) are true but R is not the correct explanation of A

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

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

33. Which of the following theorems is a manifestation of law of conservation of energy ?

(A) Tellegen's theorem

(B) Reciprocity theorem

(C) Thevenin's theorem

(D) Norton's theorem

34. An ac circuit has to branches in parallel. The impedances of the two branches are equal. The p. f. of one branch is 0.8 lagging and 0.8 leading. The overall p. f. is :
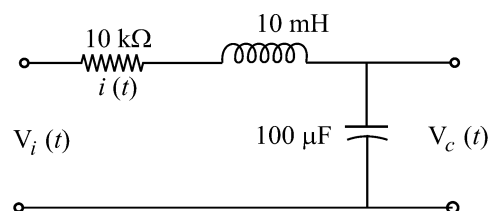
(A) zero

(B) 0.5 lagging

(C) 1

(D) 0.7 lagging

35. Choose the correct option, where H(s) is transfer function, Z(s) is driving point impedance functions :

(A) $H(s) = \dfrac{Y(s)}{X(s)}\bigg|_{\text{all } I_C = 0}$

(B) $Z_{in}(s) = \dfrac{V_{in}(s)}{I_{in}(s)}$

(C) $Z_{21}(s) = \dfrac{1}{Y_{21}(s)}$

(D) All of the above

36. For the circuit shown in the figure the initial conditions are zero. Its transfer function

is : $H(s) = \dfrac{V_C(s)}{V_i(s)}$

(A) $\dfrac{1}{s^2 + 10^6 s + 10^6}$

(B) $\dfrac{10^6}{s^2 + 10^3 s + 10^6}$

(C) $\dfrac{10^3}{s^2 + 10^3 s + 10^6}$

(D) $\dfrac{10^6}{s^2 + 10^6 s + 10^6}$

37. A capacitor with initial charge q_0 at $t = 0^+$ acts as :

(A) current source

(B) voltage source

(C) short-circuit

(D) open-circuit

38. Form factor for a sine wave is :

(A) 1.414

(B) 0.707

(C) 1.11

(D) 0.637

39. Choose the correct option, if b (branch), n (nodes), l (links) :

(A) $b = n + l - 1$

(B) no. of twigs $= n - 1$

(C) $b = n - l + 1$

(D) b, a

40. For the time domain response shown in figure the pole :

(A) lies in left half plane

(B) lies in right half plane

(C) lies at origin

(D) may be complex or imaginary

41. A system described by the following differential equation

$$\frac{d^2 y}{dt^2} + 3\frac{dy}{dt} + 2y = x(t)$$

is initially rest for input $x(t) = 2u(t)$, the output $y(t)$ is :

(A) $\left(1 - 2e^{-t} + e^{-2t}\right)u(t)$

(B) $\left(1 + 2e^{-t} + 2e^{-2t}\right)u(t)$

(C) $\left(0.5 + e^{-t} + 1.5e^{-2t}\right)u(t)$

(D) $\left(0.5 + 2e^{-t} + 2e^{-2t}\right)u(t)$

42. A parallel connection of circuits is at below resonance circuit behave as :

(A) RC circuit

(B) RL

(C) RLC

(D) resistive only

43. In a parallel connection of circuit the bandwidth in terms of R, L, C is :

(A) $B = 1/RC$

(B) $B = 1/RL$

(C) $B = 1/RLC$

(D) $B = RLC$

44. If two voltage are $v_1 = 100 \ \sin\left(\omega t - 30°\right)$ and $v_2 = \cos \omega t$, then :

(A) v_1 is leading v_2 by $30°$

(B) v_2 is leading v_1 by $30°$

(C) v_2 is leading v_1 by $60°$

(D) v_1 is leading v_2 by $60°$

45. Which one of the following functions is RC driving point impedance ?

(A) $\dfrac{s(s + 3)(s + 4)}{(s + 1)(s + 2)}$

(B) $\dfrac{(s + 3)(s + 4)}{(s + 1)(s + 2)}$

(C) $\dfrac{(s + 3)(s + 4)}{s(s + 1)(s + 2)}$

(D) $\dfrac{(s + 2)(s + 4)}{(s + 1)(s + 3)}$

46. Which of the following is not an example of a linear element ?

(A) Resistor

(B) Thermistor

(C) Inductor

(D) Capacitor

47. A semiconductor diode is a/an .... element.

(A) Bilateral

(B) Unilateral

(C) Active

(D) Passive

48. Inductance of an inductor is inversely proportional to its ....

(A) Number of turns

(B) Area of cross section

(C) Absolute permeability

(D) Length

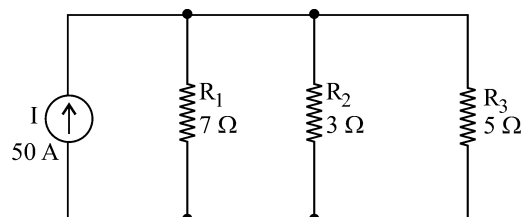49. The current law represents a mathematical statement of fact that :

(A) voltage cannot accumulate at node

(B) charge cannot accumulate at node

(C) charge at the node is infinite

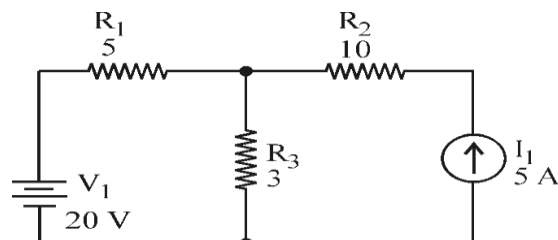(D) None of the mentioned

50. Kirchhoff's current law is applied at ....

(A) loops

(B) nodes

(C) both loop and node

(D) None of the mentioned

51. Determine the current in all resistors in the circuit shown below :

(A) 2 A, 4 A, 11 A

(B) 5 A, 4.8 A, 9.6 A

(C) 9.3 A, 20.22 A, 11 A

(D) 10.56 A, 24.65 A, 14.79 A

52. In the circuit shown, find the current through 4Ω resistor using Superposition theorem :

(A) 4

(B) 5

(C) 6

(D) 7

53. Kirchhoff's current law is applicable to only :

(A) junction in a network

(B) closed loops in a network

(C) electric circuits

(D) electronic circuits

54. Superposition theorem can be applied only to circuits having :

(A) resistive elements

(B) passive elements

(C) non-linear elements

(D) linear bilateral elements

55. An ideal voltage source should have :

(A) large value of e.m.f

(B) small value of e.m.f

(C) zero source resistance

(D) infinite source resistance

56. Any number of current source in parallel may be replaced by a single current source whose current is the algebraic sum of individual source currents and source resistance is the parallel combination of individual source resistances."

The above statement is associated with :

(A) Thevenin's theorem

(B) Millman's theorem

(C) Maximum power transfer theorem

(D) None of the above

57. Which of the following is non-linear circuit parameter ?

(A) Inductance

(B) Condenser

(C) Wire wound resistor

(D) Transistor

58. Kirchhoff's law is not applicable to circuits with :

(A) lumped parameters

(B) passive elements

(C) distributed parameters

(D) non-linear resistances

59. The circuit whose properties are same in either direction is known as :

(A) unilateral circuit

(B) bilateral circuit

(C) irreversible circuit

(D) reversible circuit

60. Which of the following is not a non-linear element ?

(A) Gas diode

(B) Heater coil

(C) Tunnel diode

(D) Electric arc

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the most correct/appropriate answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is ny discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर— A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से एक सबसे सही अथवा सबसे उपयुक्त उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।