Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Electronics) (Second Semester)

(NEP) EXAMINATION, 2025-26

NETWORK ANALYSIS AND SYNTHESIS

Paper Code							
B	1	4	0	8	0	1	T

Questions Booklet Series
D

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

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

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. 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 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। 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. Driving point admittance is :

(A) $V(s) / I(s)$

(B) $I(s) / V(s)$

(C) Power/Voltage

(D) Voltage/Power

2. The rank of an incidence matrix for a connected graph with n nodes is :

(A) n

(B) $n + 1$

(C) $n - 1$

(D) $2n$

3. Foster and Cauer forms apply mainly to :

(A) Active networks

(B) Nonlinear networks

(C) Passive networks

(D) Time varying

4. A T-network has :

(A) Two series, two shunt

(B) Two series, one shunt

(C) One series, two shunt

(D) Only shunt

5. Necessary condition for stability is :

(A) Zeros in right half-plane

(B) Poles in right half-plane

(C) Poles in left half-plane

(D) Zeros on imaginary axis

6. Which element stores energy in an electric field ?

(A) Inductor

(B) Resistor

(C) Transformer

(D) Capacitor

7. Cauer II synthesis begins by extracting :

(A) Resistance

(B) Inductance

(C) Capacitance

(D) Element at infinity

8. Determinant of ABCD matrix in reciprocal network :

(A) Zero

(B) Infinite

(C) Unity

(D) Negative

9. In an RC ladder network, the poles are usually :

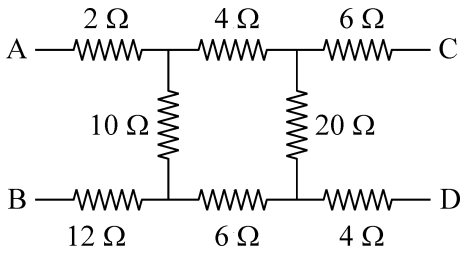
(A) Imaginary

(B) Right half-plane

(C) Real and negative

(D) Zero

10. The equivalent resistance across C and D terminal is :



(A) 20 Ω

(B) 16.85 Ω

(C) 20.50 Ω

(D) 24 Ω

11. First element extracted in Cauer I corresponds to :

(A) High frequency

(B) Low frequency

(C) Mid band

(D) Resonance

12. Lattice network commonly used in :

(A) Power supplies

(B) Biasing

(C) Filter design

(D) Rectifiers

13. The voltage transfer function of a two-port network is :

(A) $V_1(s) / I_2(s)$

(B) $I_2(s) / V_1(s)$

(C) $V_2(s) / V_1(s)$

(D) $I_1(s) / I_2(s)$

14. The dual of a series RLC circuit is a :

(A) Series RLC circuit

(B) Parallel RC circuit

(C) Parallel RLC circuit

(D) Series RL circuit

15. Which canonical form uses continued fractions ?

(A) Foster I

(B) Foster II

(C) Cauer I & II

(D) Brune

16. Hybrid parameters combine :

(A) Voltage-voltage

(B) Current-current

(C) Power-voltage

(D) Voltage-current

17. For a realizable passive network, poles and zeros must be :

(A) Complex only

(B) Repeated

(C) Simple or repeated but in left half-plane

(D) Only on real axis

18. Which theorem is used to replace a network by a single voltage source in series with a resistance ?

(A) Norton's theorem

(B) Superposition theorem

(C) Maximum power transfer theorem

(D) Thevenin's theorem

19. Foster's Second Form is suitable for :

(A) Impedance

(B) Admittance

(C) Voltage transfer

(D) Current gain

20. Unit of ABCD parameter B :

(A) Ohm

(B) Siemens

(C) 1/Ohm

(D) Dimensionless

21. The degree of denominator polynomial indicates :

(A) Number of zeros

(B) Number of ports

(C) Order of the network

(D) Network topology

22. In network graphs, a link is a branch that :

(A) Belongs to the tree

(B) Is disconnected

(C) Does not belong to the selected tree

(D) Connects two reference nodes

23. Elements in Foster form represent :

(A) Layout constraints

(B) Individual resonant modes

(C) Noise sources

(D) Loss mechanisms

24. Best parameters for cascade connection :

(A) Z

(B) Y

(C) *h*

(D) ABCD

25. A zero of a network function represents :

(A) Infinite response

(B) Unstable behavior

(C) Frequency at which response becomes zero

(D) Pole frequency

26. A tree of a graph is defined as a subgraph that :

(A) Contains all links

(B) Has maximum number of loops

(C) Connects all nodes without forming any loop

(D) Contains all branches

27. Foster's First Form realization is obtained by :

(A) Continued fraction expansion

(B) Partial fraction expansion

(C) Polynomial division

(D) Residue theorem

28. Symmetrical two-port network condition :

(A) $z_{12} = z_{21}$

(B) $y_{12} = y_{21}$

(C) $z_{11} = z_{22}$

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

29. Poles of a network function correspond to :

(A) Zeros of numerator

(B) Zeros of denominator

(C) Maximum impedance points

(D) Minimum impedance points

30. Which matrix relates node voltages to branch voltages ?

(A) Cut-set matrix

(B) Tie-set matrix

(C) Incidence matrix

(D) Admittance matrix

31. In an L-C driving point admittance, poles and zeros :

(A) Occur randomly

(B) Always repeated

(C) Alternate on imaginary axis

(D) Lie only in right half-plane

32. For reciprocal two-port network :

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

(B) $y_{11} = y_{22}$

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

(D) $h_{11} = h_{22}$

33. In a ladder network, the elements are arranged :

(A) Randomly

(B) In parallel only

(C) In series only

(D) In alternating series and shunt branches

34. In mesh analysis, the number of mesh equations is equal to the number of :

(A) Nodes

(B) Branches

(C) Independent loops

(D) Links

35. Which network contains only energy-storage elements ?

(A) R-L

(B) R-C

(C) R-L-C

(D) L-C

36. Y-parameters are also called :

(A) Impedance

(B) Hybrid

(C) Transmission

(D) Admittance

37. Which of the following is NOT a valid network function ?

(A) Impedance function

(B) Admittance function

(C) Voltage transfer function

(D) Time-domain convolution function

38. Source transformation is valid only for networks that are :

(A) Nonlinear

(B) Time-varying

(C) Linear and bilateral

(D) Passive only

39. A Hurwitz polynomial is characterized by :

(A) Roots only on imaginary axis

(B) Roots in right half-plane

(C) All roots in left half-plane or imaginary axis

(D) Complex roots only

40. Which parameter relates port voltages to currents directly ?

(A) Y

(B) *h*

(C) Z

(D) ABCD

41. For a passive network, the poles of the driving point impedance must lie :

(A) In the right half of *s*-plane

(B) On the imaginary axis only

(C) In the left half of *s*-plane or on imaginary axis

(D) Anywhere in the *s*-plane

42. Kirchhoff's Current Law (KCL) is a direct consequence of the law of :

(A) Energy conservation

(B) Charge quantization

(C) Charge conservation

(D) Momentum conservation

43. A function is said to be positive real (PR) if it is :

(A) Analytic in right half-plane

(B) Real for real s

(C) Non-negative real part for $\text{Re}(s) \geq 0$

(D) Analytic, Real and Non-negative real part

44. The Z-parameters of a two-port network are defined when :

(A) Output port short-circuited

(B) Input port short-circuited

(C) Both ports open-circuited

(D) Both ports open except measured one

45. The driving point impedance of a one-port network is expressed as :

(A) $V(s)/I(s)$ at different ports

(B) $I(s)/V(s)$ at different ports

(C) $V(s)/I(s)$ at the same port

(D) Power(s) /Voltage(s)

46. The dot convention in coupled circuits primarily indicates :

(A) Magnitude of mutual inductance

(B) Polarity of self-inductance

(C) Relative polarity of mutually induced voltages

(D) Direction of current flow

47. Network synthesis primarily deals with :

(A) Analysis of given networks

(B) Realization of a network from a given immittance function

(C) Measurement of network parameters

(D) Fault detection in networks

48. A two-port network is one which has :

(A) One input and one output terminal

(B) Two input terminals only

(C) Two pairs of terminals

(D) Four independent terminals

49. A network function is defined as the ratio of :

(A) Input impedance to output impedance

(B) Output current to output voltage

(C) Laplace transform of output to Laplace transform of input

(D) Input power to output power

50. Which of the following elements is classified as an active element ?

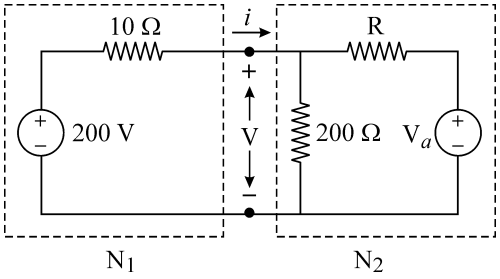
(A) Capacitor

(B) Inductor

(C) Resistor

(D) Independent voltage source

51. Consider the given network. Suppose V_a = 60 V and R is adjustable, then the value of 'R' is ..... such that maximum power is transferred through N_2 from N_1.



(A) 7Ω

(B) 8Ω

(C) 9Ω

(D) 10Ω

52. In a graph, total branches equal :

(A) Twigs only

(B) Links only

(C) Twigs + Links

(D) Nodes – 1

53. Which transformation converts Δ network into Y network ?

(A) Norton

(B) Source transformation

(C) Δ-Y transformation

(D) Laplace

54. The determinant of the incidence matrix of a connected graph is :

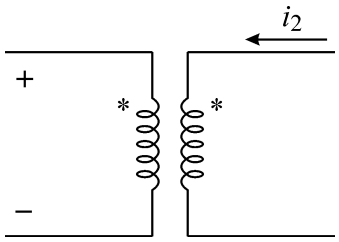
(A) Non-zero

(B) Unity

(C) Zero

(D) Infinite

55. Find nature of coupling shown :



(A) No coupling

(B) Loose coupling

(C) Mutual inductive coupling

(D) Capacitive coupling

56. Mandatory condition for realizable passive network :

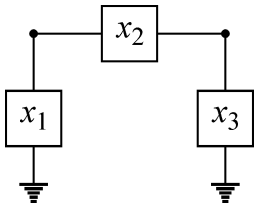
(A) Stability

(B) Rationality

(C) Positive realness

(D) Linearity

57. π-network easiest parameters to compute :



(A) Z

(B) Y

(C) *h*

(D) ABCD

58. Which matrix is fundamental for loop current analysis ?

(A) Incidence matrix

(B) Cut-set matrix

(C) Admittance matrix

(D) Tie-set matrix

59. In RC Cauer synthesis first element is :

(A) Capacitor

(B) Resistor

(C) Inductor

(D) Transformer

60. Network used for impedance matching :

(A) π

(B) T

(C) L

(D) Lattice

61. Duality in networks relates :

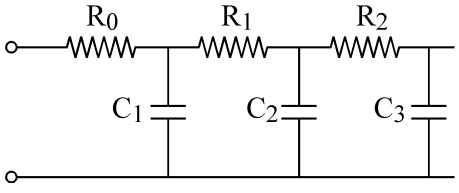
(A) Voltage and current

(B) Resistance and inductance

(C) Mesh equations and nodal equations

(D) Power and energy

62. Ladder network corresponds to :



(A) Foster I

(B) Foster II

(C) Cauer I

(D) Brune

63. In symmetrical lattice network opposite arms are :

(A) Unequal

(B) Open

(C) Equal

(D) Short

64. Network equilibrium equations are derived using :

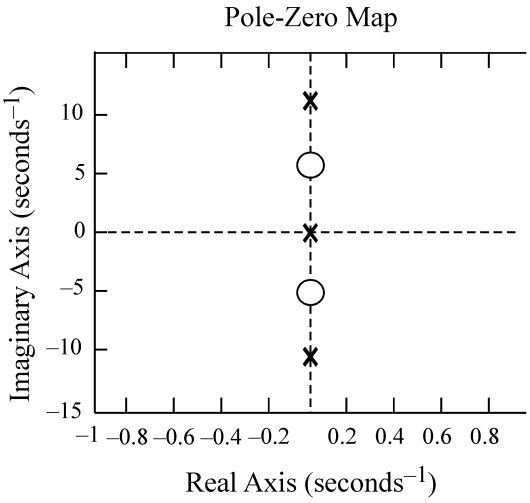
(A) Only KCL

(B) Only KVL

(C) KCL, KVL, and element laws

(D) Only Ohm's law

65. Nature of poles from plot :



(A) Right half-plane

(B) Multiple

(C) Alternating on imaginary axis

(D) Non-PR

66. Inverse ABCD gives :

(A) Y

(B) Z

(C) *h*

(D) Reversed network parameters

67. Which theorem states that total response is the sum of individual responses ?

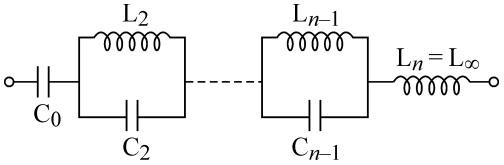
(A) Reciprocity

(B) Maximum power transfer

(C) Superposition theorem

(D) Tellegen's theorem

68. For shown LC network impedance corresponds to :



(A) Foster I

(B) Cauer II

(C) Cauer I

(D) Brune

69. Reciprocal and symmetrical network condition :

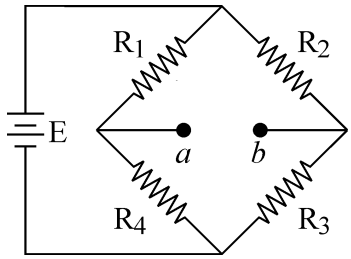
(A) $z_{11} = z_{22}$ and $z_{12} \neq z_{21}$

(B) $z_{11} = z_{22}$ and $z_{12} = z_{21}$

(C) $y_{11} \neq y_{22}$

(D) $h_{12} \neq h_{21}$

70. If V = 20V, $R_1 = R_2 = R_3 = 10\ \Omega$ and $R_4 = 20\ \Omega$ with zero source resistance the Thvenin's equivalent resistance and Thevenin's voltage for the following circuit is ..... and ..... respectively.



(A) $R_{th} = 15\Omega, V_{th} = 3.33\,V$

(B) $R_{th} = 11.66\Omega, V_{th} = 3.33\,V$

(C) $R_{th} = 11.66\Omega, V_{th} = 5\,V$

(D) $R_{th} = 15\ \Omega, V_{th} = 5\,V$

71. Cauer synthesis results in :

(A) Parallel network

(B) Ladder network

(C) Bridged-T

(D) Star-delta

72. Parallel two-port analysis uses :

(A) Z

(B) Y

(C) ABCD

(D) *h*

73. Restriction on poles of passive driving-point impedance :

(A) In right half-plane

(B) On imaginary axis only

(C) No poles in right half-plane

(D) Must be repeated

74. In graph theory, the number of fundamental loops equals the number of :

(A) Nodes

(B) Twigs

(C) Links

(D) Trees

75. Foster form preferred when :

(A) Ladder needed

(B) Parallel resonance required

(C) Compact network

(D) Minimum components

76. Best parameters for transistor modeling :

(A) Z

(B) Y

(C) *h*

(D) ABCD

77. Transfer function of two-port depends on :

(A) Source only

(B) Load only

(C) Both source and load

(D) Frequency alone

78. Tie-set matrix is formed using :

(A) Tree branches

(B) Links and tree branches

(C) Only nodes

(D) Only links

79. Pole-zero interpretation in LC indicates :

(A) Stability

(B) Dissipation

(C) Energy exchange

(D) Attenuation

80. Parameter measured with output shorted :

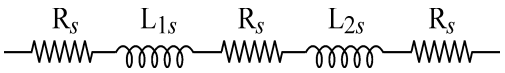
(A) z_{11}

(B) y_{11}

(C) h_{11}

(D) A

81. Ladder network R-L-R-L is suitable for :



(A) Active synthesis

(B) High-frequency oscillation

(C) Low-pass filter realization

(D) Amplification

82. Which of the following is NOT a passive element ?

(A) Resistor

(B) Capacitor

(C) Inductor

(D) Dependent source

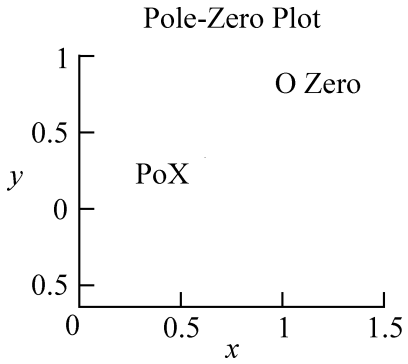
83. Immittance for LC synthesis must be :
(A) Any rational
(B) Strictly proper
(C) Positive real and odd/even
(D) Polynomial

84. Matrix form represents :

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} ? & ? \\ ? & ? \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix}$$

(A) Z
(B) Y
(C) *h*
(D) ABCD

85. From pole-zero plot, system is :

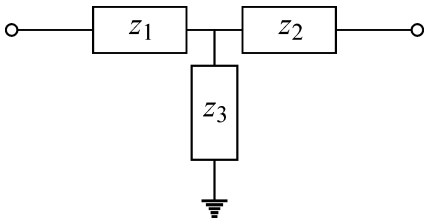


(A) Unstable
(B) Marginally stable
(C) Stable
(D) Non-causal

86. Superposition theorem simplifies analysis of :
(A) Single source circuits
(B) Multiple independent source circuits
(C) Non-linear circuits
(D) Reactive circuits only

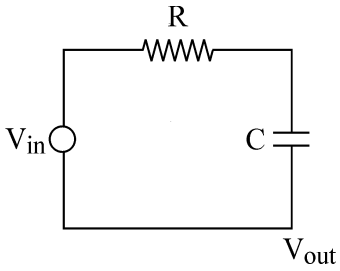
87. In Cauer synthesis end elements depend on :
(A) Residues
(B) Continued fraction coefficients
(C) Transfer zeros
(D) Topology

88. T-network easiest parameters :



(A) Y
(B) *h*
(C) Z
(D) ABCD

89. RC network shown represents :



(A) Current transfer
(B) Power transfer
(C) Voltage transfer function
(D) Impedance function

90. A network is said to be bilateral if :
(A) It has two terminals.
(B) Current flows in one direction.
(C) Its behavior is same in both directions.
(D) It contains dependent sources.

91. Identification of Foster form relies on :

(A) Frequency scaling

(B) Time response

(C) Partial fractions

(D) Laplace inversion

92. Transmission parameters also called :

(A) Hybrid

(B) Inverse

(C) Chain

(D) Admittance

93. Number of poles equals :

(A) Number of zeros

(B) Number of elements

(C) Highest power of s in denominator

(D) Number of nodes

94. The cut-set matrix is mainly associated with :

(A) Loop currents

(B) Mesh currents

(C) Branch currents

(D) Node voltages

95. Foster realization of RC network gives :

(A) Series RL

(B) Parallel RC

(C) Inductor ladder

(D) T network

96. Elements in L-network :

(A) One

(B) Two

(C) Three

(D) Four

97. Which network always yields a positive real function ?

(A) Active

(B) Passive

(C) Nonlinear

(D) Time-varying

98. Which law is primarily used in nodal analysis ?

(A) KVL

(B) Ohm's law

(C) Superposition principle

(D) KCL

99. R-L admittance is characterized by :

(A) Only poles

(B) Only zeros

(C) Poles and zeros on negative real axis

(D) Complex poles

100. Equivalent of Δ network is :

(A) π

(B) Y

(C) L

(D) T

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct 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 any 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 सही 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।